OEMAX™ CONTROLS

Maximum Value for OEMs℠

NX70 High-Speed Counter Unit (4CH)

User Manual

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Because of these differences, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will OE Max Controls be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, OE Max Controls cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by OE Max Controls with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of OE Max Controls is prohibited.

Throughout this manual we use notes to make you aware of safety considerations.

WARNING

Identifies information about practices or circumstances which may lead to serious personal injury or death, property damage, or economic loss.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

ATTENTION

Identifies information about practices or circumstances that can lead to minor personal injury, property damage, economic loss, or product malfunction. However, depending on the situation, failure to follow the directions accompanying this symbol may also lead to serious consequences.

Contents

1. High-Speed Counter Unit (4CH) Specifications 9

Performance Specifications 9
I/O Contact Points 12
Shared Memory Areas 14

2. High-Speed Counter Unit (4CH) Functions 21

High-Speed Counter Unit (4CH) Functions 21
Functions of High-Speed Counter Unit 22
Configuration and Limit for High-Speed Counter Unit 25
Parts and Functions 26
Wiring 28

3. Configuration and Design Verification of the Unit .. 31

Slot No. and I/O Number Allocation Verification 31
Embedded Counter 38

4. General I/O Function 41

General I/O Function 41

5. Input Time Constant Function 43

Input Time Constant Function 43
Use Input Time Constant Function 45

6. High-Speed Counter Function 47

High-Speed Counter Function 47
Count Function Available as Direction Control Mode 51
Count Function Available as Individual Input Mode 53
Count Function Available as Phase Input Mode 55

7. Comparison Output Function 57

Comparison Output Function 57
Comparison Output Function with Counter 60

8. Application Examples 63

Speed Measuring 63
Fixed Length Processing 65
Location Control by Absolute Value 68
Location Control by Data Table 71

Safety Instructions

Please read this manual and the related documentation thoroughly and familiarize yourself with product information, safety instructions and other directions before installing, operating, performing inspections and preventive maintenance. Make sure to follow the directions correctly to ensure normal operation of the product and your safety.

WARNING

- If this product is used in a situation that may cause personal injury and/or significant product damage, implement safe measures such as use of fault-safe equipment.
- Do not use this product under any conditions exposed to explosive gases. It may cause an explosion.

ATTENTION

- Please fasten cables with terminal bolts.
- Do not use the product under conditions that do not correct environmental standards.
- Make sure you connect grounding cables.
- Do not touch terminals when electric current is flowing.

Installation Environment

ATTENTION

Do not install your HSC unit if any of the following conditions are present:

- Ambient temperature outside the range of 0 to 55 °C (32 to 131 °F).
- Direct sunlight.
- Humidity outside the range of 30% to 85% (non-condensing).
- Chemicals that may affect electronic parts.
- Excessive or conductive dust, or salinity.
- High voltage, strong magnetic fields, or strong electromagnetic influences.
- Direct impact and excessive vibration.

ATTENTION

Precautions for Electrostatic

This unit may have excessive static in dry places. Please make sure to discharge electrostatic charges by touching a grounded metal bar before contacting the unit.

ATTENTION

Cleaning

Never use chemicals such as thinner because they melt, deform or discolor PCB boards

Compatibility between High-speed Counter Unit (1CH or 2CH) and High-performance High-speed Counter Unit (4CH)

- No compatibility of hardware and software
- Incompatible ladder program

Comparison between High-speed Counter Unit (1CH or 2CH) and High-performance High-speed Counter Unit (4CH)

Item		High-Speed Counter Unit		High-Performance High-Speed Counter Unit
		NX70 (NX70-HSC1)	NX70 (NX70-HSC2)	NX70 (NX70-HSC4)
High-speed Counter function	Number of channels	1CH	2CH	4CH
	Max. counting speed	Max. 100KHz		Max. 200KHz
	Counting range	Signed 24-bit binary (-16,777,216 to +16,777,215)		Signed 32-bit binary (-2,147,483,648 to +2,147,483,647)
	Min. input pulse width	5 μs		2.5 μs
	Comparison output	2 points, (C=P, C>P)	4 points, (C=P, C>P) x 2	8 points, Any settings available for 8 target values
Input time constant function		N/A		4 μs, 8 μs, 16 μs, 32 μs(2 input unit setting)

NOTE High-Performance counter unit (4CH) is available for following module.
- NX70 CPU Module: NX70-CPU750

Reference Manuals

NX70 Controller User Manual

NX7/NX70 Instruction Set Reference Manual

WinGPC Software User Manual

Click “HELP” on the WinGPC S/W screen or contact your local distributor.

1

High-Speed Counter Unit (4CH) Specifications

Performance Specifications

General Specifications

Item		Specifications
Temperature	Operating	0 °C to +55 °C (32 °F to 131 °F)
	Storage	-25 °C to +70 °C (-13 °F to 158 °F)
Humidity	Operating	30 to 85% RH (Non-condensing)
	Storage	30 to 85% RH (Non-condensing)
Withstand voltage		500V ac for 1 minute, between each pin <-> groundings of external connectors (Except F and E terminals) (F and E terminals: connector shield cables)
Insulation resistance		100 MΩ or more at 500 V DC between each pin <-> groundings of external connectors (Except F and E terminals) (F and E terminals: connector shield cables)
Vibration immunity		10 to 55 Hz, 1 cycle/minute: double amplitude of 0.75 mm, 10 minutes on 3 axis (X, Y, Z)
Shock immunity		Peak acceleration and duration 98 m/s^2 or more, 4 times for each X, Y, Z direction
Noise immunity		1500Vp-p with 50ns to 1 μs pulse width (generated by noise simulator)
Ambience		No corrosive gas, no excessive dust

I/O Specification

Common Specifications

Item	High-speed counter unit (NX70-HSC4)
Occupied I/O points	Input 32 points, output 32 points
Internal Current Consumption	500 mA or less (5V DC)
Operation Indicator	32 point LED
External connection method	Connector (One MIL standard 40P connector)
Weight	Approx. 130g

Input Specifications

Item			High-speed counter unit (NX70-HSC4)
Input	Isolation method		Photocoupler
	Rated input voltage		24V DC
	Rated input current		Approx. 7.5 mA (at 24V DC)
	Input impedance		Approx. 3.2 KΩ
	Voltage range		20.4V DC to 26.4V DC
	Min. ON voltage/current		19.2V DC/6 mA
	Max. OFF voltage/current		5.0V DC/1.5 mA
	Response time [1]	OFF → ON	1 μs or less
		ON → OFF	2 μs or less
	Input time constant setting		N/A, 4 μs, 8 μs, 16 μs, 32 μs (2 input unit setting)
	Common method		16 points/Common (+Common)
Counter	Number of counter channels		4 CH
	Counting range		32-bit signed (-2,147,483,648 to +2,147,483,647)
	Max. counting speed [1]		200 kHz
	Input mode		3 modes (Direction control, individual input, phase input)
	Min. input pulse width [1]		2.5 μs
	Others		Comparison output 8 points, multiplication (1, 2, 4)

[1] This value applies when the input time constant (filter) function is disabled.

Output Specification

Item			High-speed counter unit (NX70-HSC4)
Output	Isolation method		Photocoupler
	Rated load voltage		5V to 24V DC
	Rated load voltage range		4.75V DC to 26.4V DC
	Max. load current		0.1A (**[** II **]** A1 to A8, **[** II **]** B1 to B4 terminal), 0.8A (**[** II **]** B5 to B8 terminal)
	OFF state leakage current		1 μA or less
	Max. ON state voltage drop		0.5V or less
	Response time(1)	OFF → ON	1 μs or less
		ON → OFF	1 μs or less
	Surge absorber		Zener diode
	Common method		16 points/COMMON
	External power supply	Voltage	20.4V DC to 26.4V DC
		Current	90 mA (for 24V DC)
Counter	Comparison output		8 points (**[** II **]** A1 to A8 terminal)

Function Specification

Functions	Item	High-speed counter unit (NX70-HSC4)
Input, Output	Occupied I/O points	32 In/32 Out
	External point	16 In/16 Out
Counter	Number of channels	4CH
	Counting range	32-bit signed (-2,147,483,648 to +2,147,483,647)
	Counting speed	200 kHz (1)
	Input mode	Direction control input, individual input, phase differential input
	Special functions	Multiplication (1, 2, 4)
Comparison output	Point	Max. 8 points
Input time constant	Point	16 points (2-point unit)
	Constant	4, 8, 16, 32 μs

(1) This value applies when the input time constant (filter) function is disabled.

I/O Contact Points

NX70 High-Speed Counter Unit (NX70-HSC4)

Input Contacts

NX70 High-Speed Counter Unit (NX70-HSC4)

	External Terminal	Functions				
		Input	Counter	Comparison	Pulse	PWM
External Terminal [I]	A1	R0.0	CH0 IN-A	-	-	-
	A2	R0.1	CH0 IN-B	-	-	-
	A3	R0.2	CH0 Clear	-	-	-
	A4	R0.3	CH0 Mask	-	-	-
	A5	R0.4	CH1 IN-A	-	-	-
	A6	R0.5	CH1 IN-B	-	-	-
	A7	R0.6	CH1 Clear	-	-	-
	A8	R0.7	CH1 Mask	-	-	-
	B1	R0.8	CH2 IN-A	-	-	-
	B2	R0.9	CH2 IN-B	-	-	-
	B3	R0.10	CH2 Clear	-	-	-
	B4	R0.11	CH2 Mask	-	-	-
	B5	R0.12	CH3 IN-A	-	-	-
	B6	R0.13	CH3 IN-B	-	-	-
	B7	R0.14	CH3 Clear	-	-	-
	B8	R0.15	CH3 Mask	-	-	-
Unit Internal I/O	-	R1.0	-	Comparison CMP0	-	-
	-	R1.1	-	Comparison CMP1	-	-
	-	R1.2	-	Comparison CMP2	-	-
	-	R1.3	-	Comparison CMP3	-	-
	-	R1.4	-	Comparison CMP4	-	-
	-	R1.5	-	Comparison CMP5	-	-
	-	R1.6	-	Comparison CMP6	-	-
	-	R1.7	-	Comparison CMP7	-	-
	-	R1.8	-	-	-	-
	-	R1.9	-	-	-	-
	-	R1.10	-	-	-	-
	-	R1.11	-	-	-	-
	-	R1.12	-	-	-	-
	-	R1.13	-	-	-	-
	-	R1.14	-	-	-	-
	-	R1.15	-	-	-	-

- : No input allocation.

ATTENTION

The I/O number allocations above are applied when NX70 PLC High-speed counter unit is installed in slot 0. I/O number can differ depending on the installation slot.

Output Contacts

	External Terminal	Functions				
		Output	Counter	Comparison	Pulse	PWM
External Terminal [II]	A1	R2.0	-	[Comparison CMP0]	-	-
	A2	R2.1	-	[Comparison CMP1]	-	-
	A3	R2.2	-	[Comparison CMP2]	-	-
	A4	R2.3	-	[Comparison CMP3]	-	-
	A5	R2.4	-	[Comparison CMP4]	-	-
	A6	R2.5	-	[Comparison CMP5]	-	-
	A7	R2.6	-	[Comparison CMP6]	-	-
	A8	R2.7	-	[Comparison CMP7]	-	-
	B1	R2.8	-	-	-	-
	B2	R2.9	-	-	-	-
	B3	R2.10	-	-	-	-
	B4	R2.11	-	-	-	-
	B5	R2.12	-	-	-	-
	B6	R213	-	-	-	-
	B7	R2.14	-	-	-	-
	B8	R2.15	-	-	-	-
Unit Internal I/O	-	R3.0	CH0 Soft Clear	-	-	-
	-	R3.1	CH0 Soft Mask	-	-	-
	-	R3.2	CH1 Soft Clear	-	-	-
	-	R3.3	CH1 Soft Mask	-	-	-
	-	R3.4	CH2 Soft Clear	-	-	-
	-	R3.5	CH2 Soft Mask	-	-	-
	-	R3.6	CH3 Soft Clear	-	-	-
	-	R3.7	CH3 Soft Mask	-	-	-
	-	R3.8	-	-	-	-
	-	R3.9	-	-	-	-
	-	R3.10	-	-	-	-
	-	R3.11	-	-	-	-
	-	R3.12	-	-	-	-
	-	R3.13	-	-	-	-
	-	R3.14	-	-	-	-
	-	R3.15	-	-	-	-

- : No output allocation

[ ] : Indicate the connector pins on which the comparison results are directly output in order to send to an external device. But the signal states are saved in the input contacts, R1.0 to R1.7, so that you can monitor them with the programming software.

ATTENTION

The I/O number allocations above are applied when NX70 PLC High-speed counter unit is installed in slot 0. I/O number can differ depending on the installation slot.

Shared Memory Areas

NX70 PLC High-speed counter unit (4CH) shared memory map.

Shared Memory Map

Address	Access unit [word]	Functions	R/W	Event
100h, 101h	2W	Counter setting	R/W	Counter functions setting
102h, 103h	2W	Reserved		
104h, 105h	2W	Comparison output setting		Comparison output setting
106h, 107h	2W	Reserved		
108h, 109h	2W	Counter <CH0> Current value	R/W	CH0 Counter Current value (signed 32-bit)
10Ah, 10Bh	2W	Counter <CH1> Current value	R/W	CH1 Counter Current value (signed 32-bit)
10Ch, 10Dh	2W	Counter <CH2> Current value	R/W	CH2 Counter Current value (signed 32-bit)
10Eh, 10Fh	2W	Counter <CH3> Current value	R/W	CH3 Counter Current value (signed 32-bit)
110h to 11Fh	2W	Reserved		
120h, 121h	2W	Comparison output Set value MEM0	R/W	Comparison with counter current value (signed 32-bit)
122h, 123h	2W	Comparison output Set value MEM1	R/W	Comparison with counter current value (signed 32-bit)
124h, 125h	2W	Comparison output Set value MEM2	R/W	Comparison with counter current value (signed 32-bit)
126h, 127h	2W	Comparison output Set value MEM3	R/W	Comparison with counter current value (signed 32-bit)
128h, 129h	2W	Comparison output Set value MEM4	R/W	Comparison with counter current value (signed 32-bit)
12Ah, 12Bh	2W	Comparison output Set value MEM5	R/W	Comparison with counter current value (signed 32-bit)
12Ch, 12Dh	2W	Comparison output Set value MEM6	R/W	Comparison with counter current value (signed 32-bit)
12Eh, 12Fh	2W	Comparison output Set value MEM7	R/W	Comparison with counter current value (signed 32-bit)
130h to 137h	2W	Reserved		
138h, 139h	2W	Reserved		
13Ah, 13Bh	2W	Reserved		
13Ch, 13Dh	2W	Input time constant setting	R/W	Input time constant setting for input R0.0 to R0.15
13Eh, 13Fh	2W	Reserved		
140h to 15Fh	2W	Reserved		

NOTE R/W: Read and write. R: Read only.

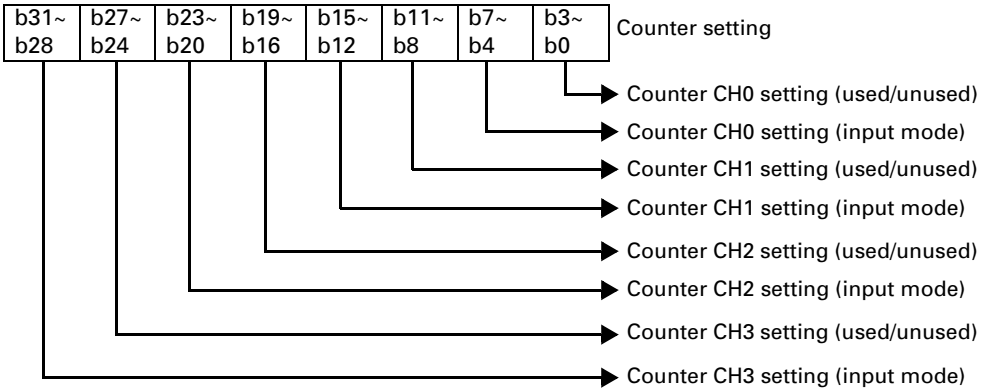
Shared Memory Area Description

Below is a description of NX70 PLC high-speed counter (4CH) unit shared memory.

100h, 101h	Counter functions setting

Address: 100h 101h

Setting of each counter CH operation mode with shared memory settings. Please configure the counter function modes according to the table on the right.



Setting (Input Mode): Effective only for terminal input

Set value (HEX)	Functions	
	Terminal input mode	Multiplication
0	Direction control[2]	N/A
1	Individual input	
2	Phase input	1 multiplication
3		2 multiplications
4		4 multiplications
5	Invalid[1]	
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

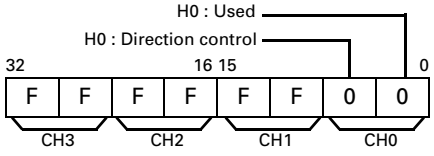
Setting (Function)

Set value (HEX)	Functions
	Counter
0	Used (Terminal input)
1	
2	Invalid[1]
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	Unused[2]

[1] Do not use this setting.

[2] Initial values on power input are set as direction control for input mode and unused for function setting.

Shared Memory Area Setting Example

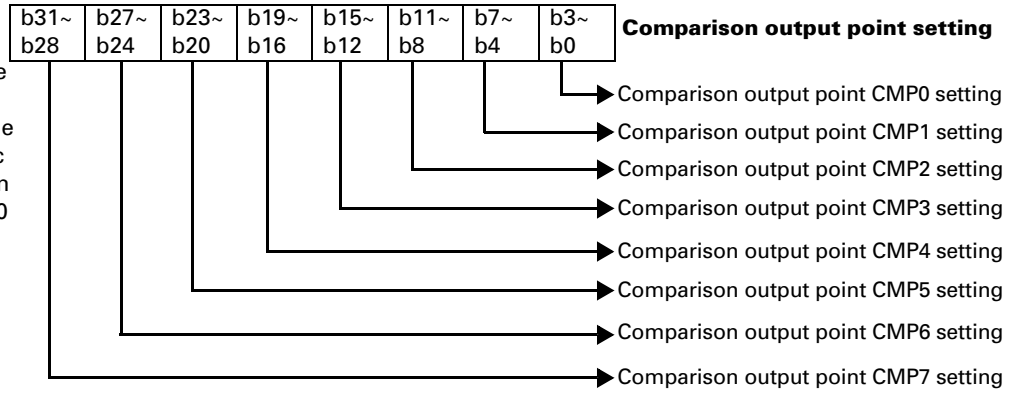
Setting item	Shared memory address	Setting example	Setting range
Counter	100h to 101h	For each channel (CH0 to CH3), 8 bits are allocated. 	Setting range for each channel H00 : Direction control H10 : Individual input H20 : Phase input (1 multiplication) H30 : Phase input (2 multiplications) H40 : Phase input (4 multiplications) HFF : Unused

102h, 103h	Reserved

104h, 105h	Comparison output setting

Address: 104h, 105h

Select the counter channel whose current value will be compared with the comparison set value and the output logic for each comparison output points, CMP0 to CMP7.



Comparison Output Setting

Set value (HEX)	Comparison output functions	Functions	
		Output logic	Counter CH to be compared
0	Used	ON when current value < set value	CH0
1			CH1
2			CH2
3			CH3
4		ON when current value ≥ set value	CH0
5			CH1
6			CH2
7			CH3
8	Invalid[1]	Invalid[1]	
9			
A			
B			
C			
D			
E			
F	Unused[2]	-	

[1] Do not use this setting.

[2] Initial value on power input is set to Unused.

Shared Memory Area Setting Example

Setting item	Shared memory address	Setting example	Setting range
Comparison output setting	104h to 105h	For comparison output 8 points (CMP0 to CMP7), 4 bits are allocated for each. H0: Negative logic output counter CH0 32 16 15 0 F F F F F F F 0 CMP7 CMP6 CMP5 CMP4 CMP3 CMP2 CMP1 CMP0	Setting range for each channel ON when current value < set value 1) H0 : CH0 2) H1 : CH1 3) H2 : CH2 4) H3 : CH3 ON when current value ≥ set value 1) H4 : CH0 2) H5 : CH1 3) H6 : CH2 4) H7 : CH3 5) HF : Unused

106h, 107h	Reserved

108h to 10Fh	Counter <CHx> Current value

- Current value of each counter is stored in shared memory as described below.
- Use the READ instruction (reading data from high-performance units) to read the current value by 2 word unit.

Counter CH0 Current value	Address: 108h 109h	K-2,147,483,648 to K+2,147,483,647
Counter CH1 Current value	Address: 10Ah 10Bh	K-2,147,483,648 to K+2,147,483,647
Counter CH2 Current value	Address: 10Ch 10Dh	K-2,147,483,648 to K+2,147,483,647
Counter CH3 Current value	Address: 10Eh 10Fh	K-2,147,483,648 to K+2,147,483,647

110h to 11Fh	Reserved

120h to 12Fh	Comparison output set value

- Set the comparison output set value to be compared with counter current value.

Comparison output Set value (for CMP0)	MEM0	Address: 120h 121h	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP1)	MEM1	Address: 122h 123h	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP2)	MEM2	Address: 124h 125h	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP3)	MEM3	Address: 126h 127h	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP4)	MEM4	Address: 128h 129h	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP5)	MEM5	Address: 12Ah 12Bh	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP6)	MEM6	Address: 12Ch 12Dh	K-2,147,483,648 to K+2,147,483,647
Comparison output Set value (for CMP7)	MEM7	Address: 12Eh 12Fh	K-2,147,483,648 to K+2,147,483,647

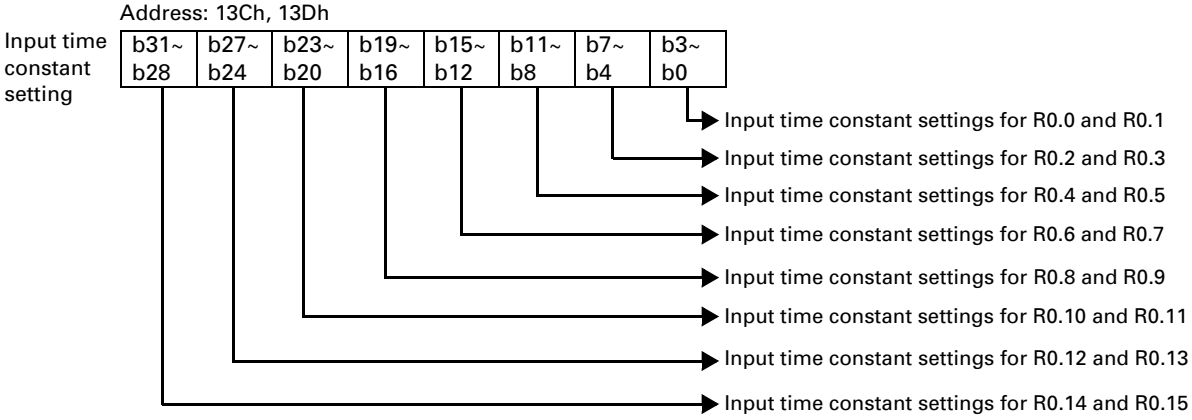
130h to 137h	Reserved

138h, 139h	Reserved

13Ah, 13Bh	Reserved

13Ch, 13Dh	Input time constant setting

- Set the input time constant for 8 external input terminal groups with shared memory settings.
- Input time constant is set for external input terminal, so function allocation for each of input R0.0 to R0.15 settings are also valid. (Counter input)

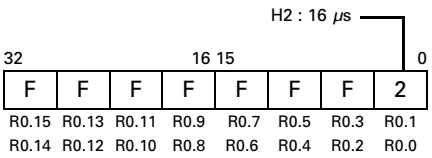


Input Time Constant Setting

Set value (HEX)	Functions	
	Input time constant	Effective pulse width
0	Used	4 μs
1		8 μs
2		16 μs
3		32 μs
4	Invalid(1)	Invalid(1)
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F	Unused(2)	-

(1) Do not use this setting.
(2) Initial value on power input is set to unused.

Shared Memory Area Setting Example

Setting item	Shared memory address	Setting example	Setting range
Input time constant	13Ch to 13Dh	For inputs (R0.0, R0.1 to R0.14, R0.15), 4 bits are allocated for each input. 	Input time constant setting range H0 : 4 μs H1 : 8 μs H2 : 16 μs H2 : 32 μs HF : Unused

13Eh, 13Fh	Reserved
140h to 15Fh	Reserved

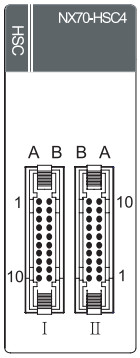
2

High-Speed Counter Unit (4CH) Functions

High-Speed Counter Unit (4CH) Functions

NX70 PLC high-speed counter unit is a special unit for fast counter feature, which also provides a variety of functions. Main features of high-speed counter unit include the following.

HSC provides various functions as follows:



NX70 PLC
High-Speed Counter
Unit(NX70-HSC4)

It operates as mixed I/O unit.	General I/O Function (See *"Chapter 4"*)
Set the effective pulse width of input signal.	Input Time Constant Function (See *"Chapter 5"*)
Count pulse number.	Counter Function (See *"Chapter 6"*)
Compare pulse number and set value and output the results.	Comparison Output Function (See *"Chapter 7"*)

System Configuration Without Losses

Unit I/O terminals that are not allocated to any function can be used for general I/O terminal, which enables a single high-speed counter unit to be used both for counter function and sensor Input, providing system configuration without system resource loss.

Four 0.8A Outputs

Functions of High-Speed Counter Unit

- Each function can be operated by shared memory settings.

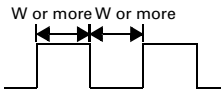
General I/O Functions

- High-speed counter unit can be used as 32In/32Out mixed I/O unit with its default setting without mode setting switch or shared memory configuration.
  But, I/O is initially allocated for 16 points for each, actually it will be used as 16In/16Out mixed I/O unit.
- I/O allocation changes depending on unit installation slot.
  (Ex.) When unit is installed in slot 0, occupied I/O will be R0 to R1, R2 to R3, and the actual allocation for terminal will be R0 and R2.
- Function I/O will set as priority when using functions, but for areas without function allocation, they will be used for general I/O.

Input Time Constant Functions

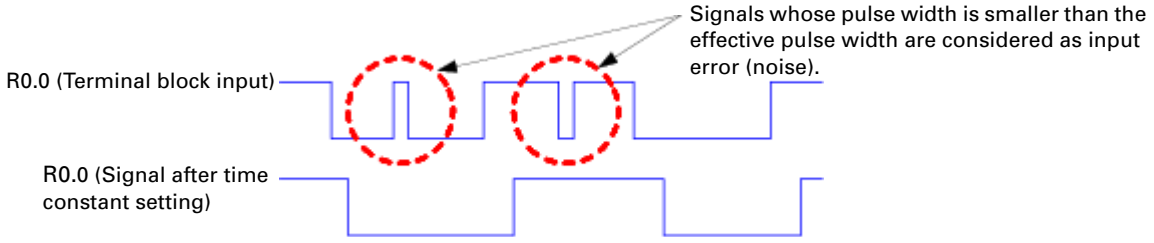
- Effective pulse width for input signals form I/O connector can be set by this function.
  Input signal whose pulse width is smaller than the effective pulse width is considered as noise.
- Effective pulse width can be set by four constants, two point unit for I/O connector, as described below.

Effective Pulse Width (Wμs)	Max. count speed
No setting	200 kHz
4	125 kHz
8	62.5 kHz
16	31.2 kHz
32	15.6 kHz



Setting Unit	External input terminal
	NX70 High-Speed Counter Unit
Group 1	[I] A1, A2 (Input allocation R0.0, R0.1)
Group 2	[I] A3, A4 (Input allocation R0.2, R0.3)
Group 3	[I] A5, A6 (Input allocation R0.4, R0.5)
Group 4	[I] A7, A8 (Input allocation R0.6, R0.7)
Group 5	[I] B1, B2 (Input allocation R0.8, R0.9)
Group 6	[I] B3, B4 (Input allocation R0.10, R0.11)
Group 7	[I] B5, B6 (Input allocation R0.12, R0.13)
Group 8	[I] B7, B8 (Input allocation R0.14, R0.15)

- Input time constant function prevents input errors caused by noise, by setting the effective pulse width of input signals. See *"Chapter 5"* for detailed setting for input time constant.

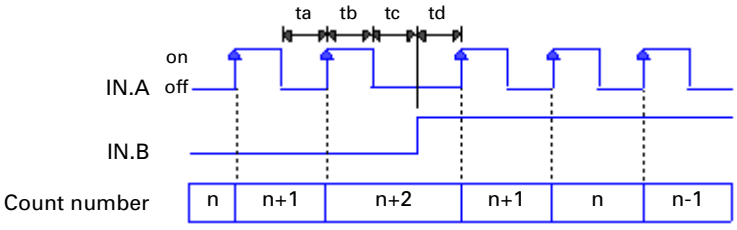


ATTENTION Be careful that the default is set to no time constant setting.

HSC has four high-speed counter channels. There are three input modes for counting. Input mode can be set for each CH.

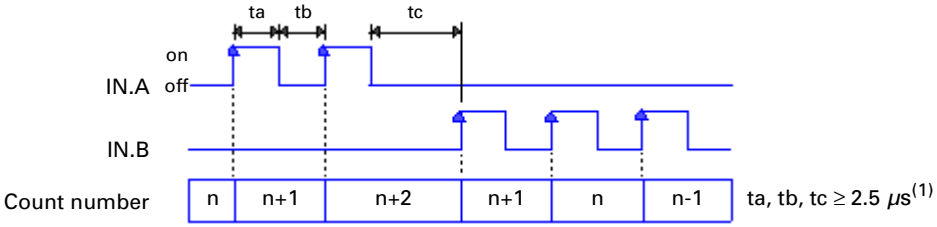
Direction control

Counter value changes with pulse string and direction signals.



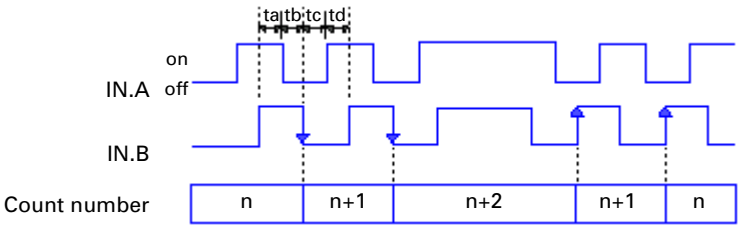
Individual input

Count value changes with each input signal at CW and CCW.



Phase differential

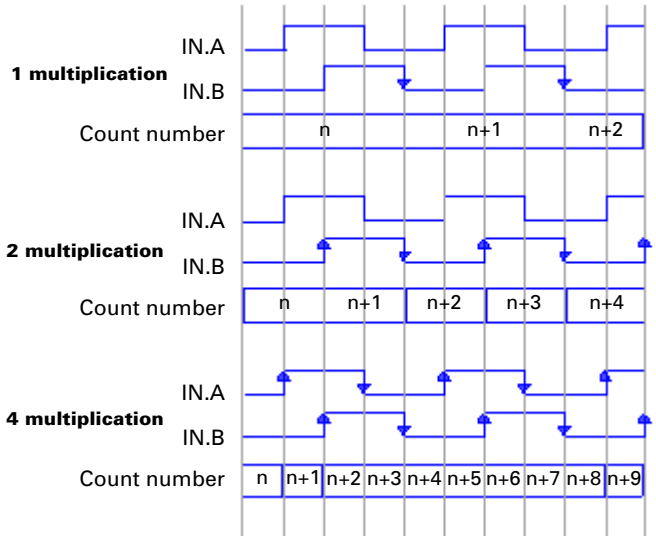
Count value changes with the phase differential input on encoder and others.

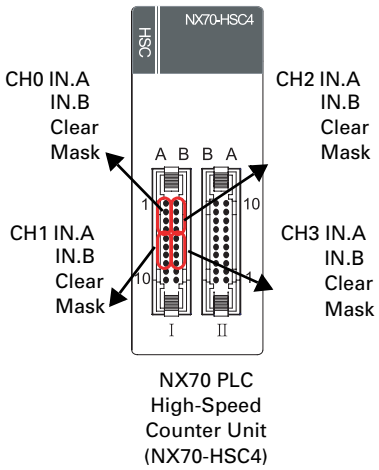


(1) Value for when input time constant (filter) is set to None.

IMPORTANT About multiplication

There are three types of multiplication for phase differential input mode as following.

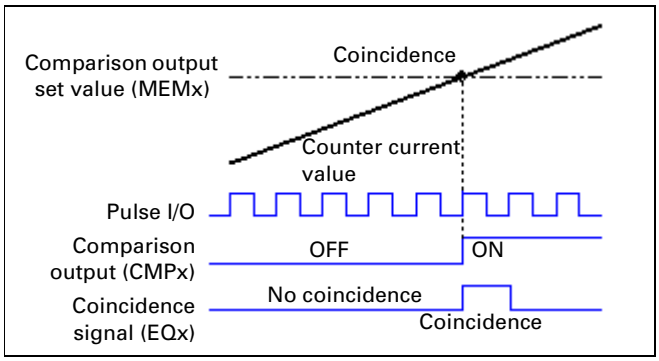




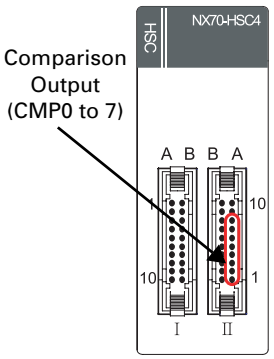
NX70 PLC
High-Speed
Counter Unit
(NX70-HSC4)

Comparison Output Function

- High-speed counter unit has 8 points of comparison output. (CMP0 to CMP7)
- Counter current value and comparison set value is compared, and the comparison results are output.
  Comparison output set value is set by shared memory. (MEM0 to MEM7)
  (Counter current value) < (Comparison output set value) → Comparison output: OFF
  (Counter current value) ≥ (Comparison output set value) → Comparison output: ON



Comparison output ON/OFF can also be set as reverse operation.
EQx is an internal processing signal that is not sent outside.



NX70 PLC
High-Speed
Counter Unit
(NX70-HSC4)

Configuration and Limit for High-Speed Counter Unit

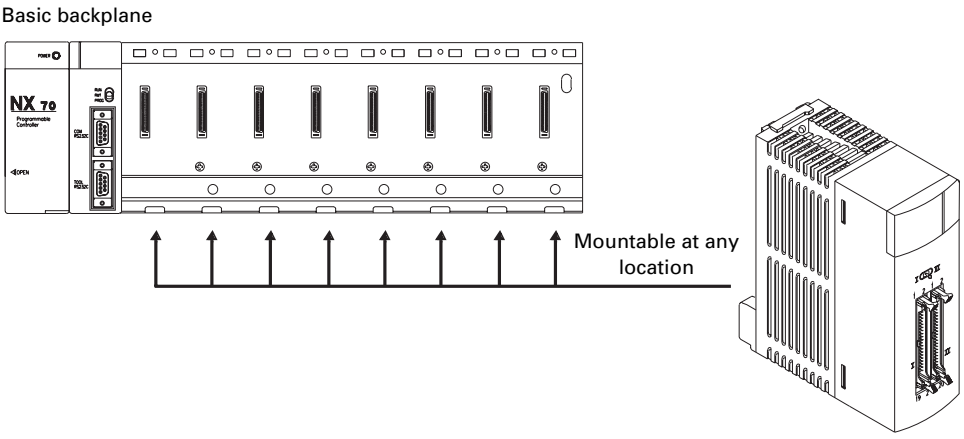
Configuration Limit with Current Consumption

Internal current consumption for HSC unit is shown below (at 5V). Be careful when configuring system, not to exceed the total capacity limit, considering the consumption of other units.

PLC Model	Name	Catalog number	Current consumption (5V power)	Remarks
NX70 PLC	High-Performance high-speed counter unit (4CH)	NX70-HSC4	400 mA	

Mounting of High-Speed Counter Unit

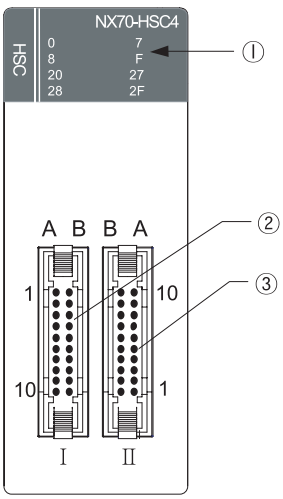
HSC unit can be mounted at any location on the basic backplane. But it cannot be mounted on power supply unit or CPU unit slots. There is no limit to the number of HSC mounting for NX70 PLC.



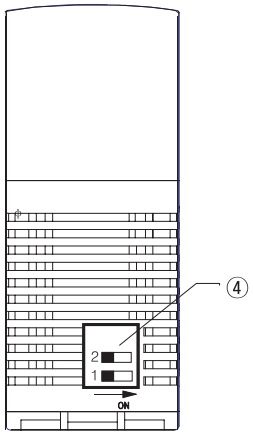
NOTE **HSC unit can be used for only the following CPU module.**
NX70 CPU Module: NX70-CPU750

Parts and Functions

Parts and Functions



NX70 PLC
High-Speed Counter Unit
(NX70-HSC4)



Bottom of Unit

1. **Status LED**
   Turns on showing the I/O status at the terminal blocks.
   See *"Status LEDs" on page 27* for details.

2. **Input Connector (NX70 PLC), [I]**
   Relays input signals from an external device to the high-speed counter unit. See *"Terminal Pinouts" on page 28*.

3. **Output Connector (NX70 PLC), [II]**
   Relays output signals from the high-speed counter unit to an external device. See *"Terminal Pinouts" on page 28*.

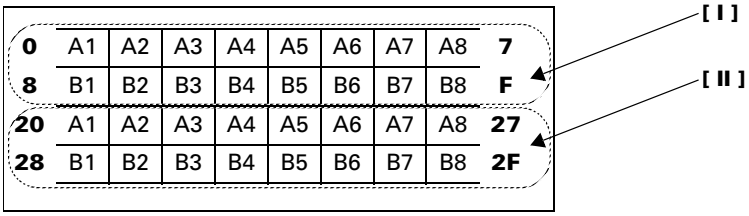
4. **Mode Setting Switch**
   Mode setting switch is reserved for future use.

ATTENTION Operation mode setting switch turns effective only on power input.

Status LEDs

Unit LED indicates the I/O status at the terminals. Refer to the table below.

NX70 high-speed counter unit allocation table (NX70-HSC4)



[Unit LED Indicator Window]

NX70 High-speed Counter unit (NX70-HSC4)

LED		Functions					LED		Functions				
		Input	Counter	Comparison	Pulse	PWM			Output	Counter	Comparison	Pulse	PWM
[I]	A1	R0.0	CH0 IN-A	-	-	-	[II]	A1	R2.0	-	[CMP0]	-	-
	A2	R0.1	CH0 IN-B	-	-	-		A2	R2.1	-	[CMP1]	-	-
	A3	R0.2	CH0 Clear	-	-	-		A3	R2.2	-	[CMP2]	-	-
	A4	R0.3	CH0 Mask	-	-	-		A4	R2.3	-	[CMP3]	-	-
	A5	R0.4	CH1 IN-A	-	-	-		A5	R2.4	-	[CMP4]	-	-
	A6	R0.5	CH1 IN-B	-	-	-		A6	R2.5	-	[CMP5]	-	-
	A7	R0.6	CH1 Clear	-	-	-		A7	R2.6	-	[CMP6]	-	-
	A8	R0.7	CH1 Mask	-	-	-		A8	R2.7	-	[CMP7]	-	-
	B1	R0.8	CH2 IN-A	-	-	-		B1	R2.8	-	-	-	-
	B2	R0.9	CH2 IN-B	-	-	-		B2	R2.9	-	-	-	-
	B3	R0.10	CH2 Clear	-	-	-		B3	R2.10	-	-	-	-
	B4	R0.11	CH2 Mask	-	-	-		B4	R2.11	-	-	-	-
	B5	R0.12	CH3 IN-A	-	-	-		B5	R2.12	-	-	-	-
	B6	R0.13	CH3 IN-B	-	-	-		B6	R2.13	-	-	-	-
	B7	R0.14	CH3 Clear	-	-	-		B7	R2.14	-	-	-	-
	B8	R0.15	CH3 Mask	-	-	-		B8	R2.15	-	-	-	-

- marks: No output allocation

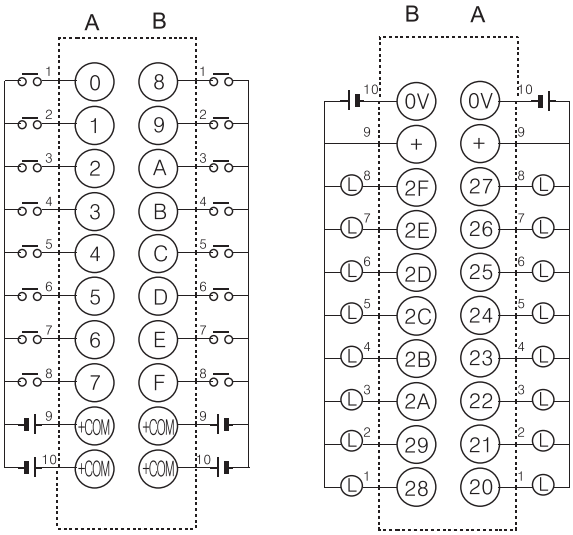
[ ] marks: Indicate the connector pins on which the comparison results are directly output in order to send to an external device. But the signal states are saved in the input contacts, R1.0 to R1.7, so that you can monitor them with the programming software.

ATTENTION

- LED indicators may show vibrations when there are high-speed I/O signals, but it does not indicate any malfunctions on the unit.
- The numbers described above are I/O numbers with high-speed counter unit mounted in slot 0. I/O number can differ depending on the installation slot.

Wiring

Terminal Pinouts



[I]
Input part

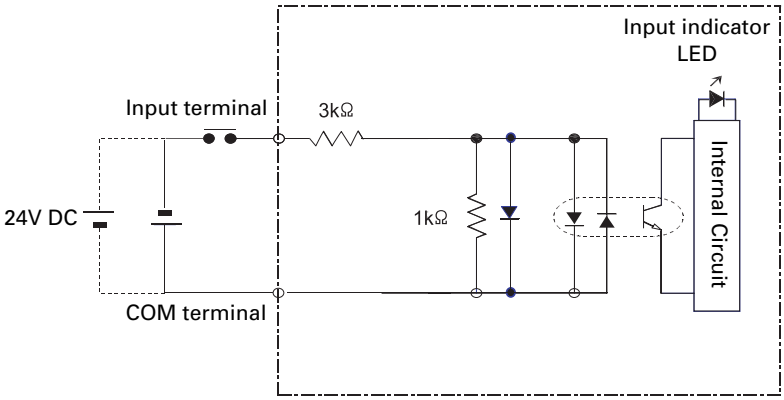
[II]
Output part

[NX70 High-Speed Counter Unit (NX70-HSC4)]

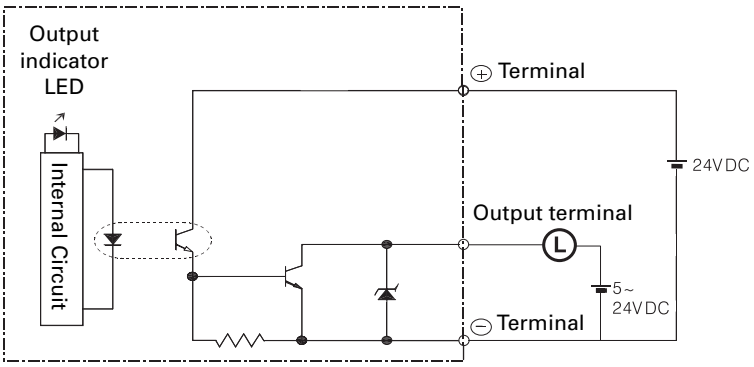
NOTE 4 (+ COM) points, 2 (+) points, and 2 (0V) points are internally connected, respectively.

Wiring Diagrams

Input Part



Output Part



3

Configuration and Design Verification of the Unit

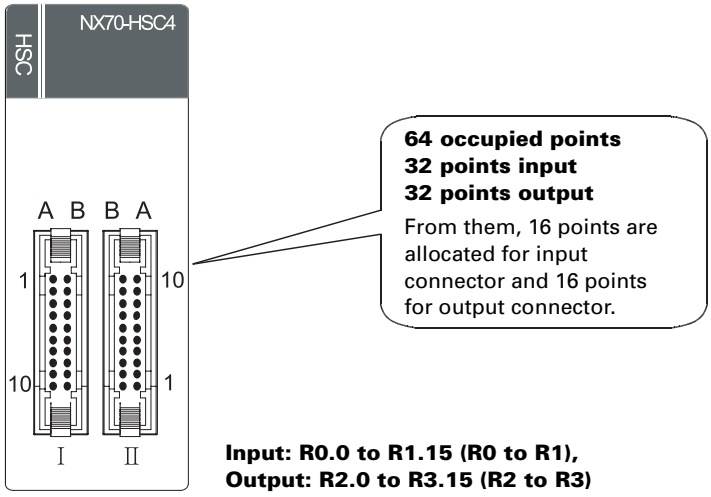
Slot No. and I/O Number Allocation Verification

Occupied I/O Area

As with other I/O units, NX70 HSC unit also uses the allocation for input (R)/output (R).

NX70 HSC unit occupies 32 input (R0.0 to R1.15) and 32 output (R2.0 to R3.15) points. Occupied I/O area configuration is as follows:

(Ex.) When HSC unit is installed in slot 0



NX70 PLC High-Speed Counter Unit (NX70-HSC4)

High-Speed Counter Unit I/O Allocation Table

Input Allocation, NX70 High-Speed Counter Unit (NX70-HSC4)

	External Terminal	Functions				
		Input	Counter	Comparison	Pulse	PWM
External Terminal [I]	A1	R0.0	CH0 IN-A	-	-	-
	A2	R0.1	CH0 IN-B	-	-	-
	A3	R0.2	CH0 Clear	-	-	-
	A4	R0.3	CH0 Mask	-	-	-
	A5	R0.4	CH1 IN-A	-	-	-
	A6	R0.5	CH1 IN-B	-	-	-
	A7	R0.6	CH1 Clear	-	-	-
	A8	R0.7	CH1 Mask	-	-	-
	B1	R0.8	CH2 IN-A	-	-	-
	B2	R0.9	CH2 IN-B	-	-	-
	B3	R0.10	CH2 Clear	-	-	-
	B4	R0.11	CH2 Mask	-	-	-
	B5	R0.12	CH3 IN-A	-	-	-
	B6	R0.13	CH3 IN-B	-	-	-
	B7	R0.14	CH3 Clear	-	-	-
	B8	R0.15	CH3 Mask	-	-	-
Unit Internal I/O	-	R1.0	-	Comparison CMP0	-	-
	-	R1.1	-	Comparison CMP1	-	-
	-	R1.2	-	Comparison CMP2	-	-
	-	R1.3	-	Comparison CMP3	-	-
	-	R1.4	-	Comparison CMP4	-	-
	-	R1.5	-	Comparison CMP5	-	-
	-	R1.6	-	Comparison CMP6	-	-
	-	R1.7	-	Comparison CMP7	-	-
	-	R1.8	-	-	-	-
	-	R1.9	-	-	-	-
	-	R1.10	-	-	-	-
	-	R1.11	-	-	-	-
	-	R1.12	-	-	-	-
	-	R1.13	-	-	-	-
	-	R1.14	-	-	-	-
	-	R1.15	-	-	-	-

- : No input allocation.

The I/O number allocations above are applied when NX70 High-speed counter unit(4CH) is installed in slot 0.
I/O number can differ depending on the installation slot.

Detailed Descriptions on Occupied I/O points

External Input

R0.0 to R0.15 ..... **Input**

Operated as input.
It can be monitored as input even though counter function is in use.

CHx IN-A, CHx IN-B .....**Counter Function**

Input count signal of counting operation.

Count signal input is IN-A, IN-B.

There are three input modes: 1) Direction control 2) Individual input and 3) Phase input.

CHx Clear .....**Counter Function**

Input when counter current value is to be cleared.

Count current value is cleared to zero (0) with this input.

CHx Mask .....**Counter Function**

Pause counter.

When this input turns on, counter is paused.

Internal input

R1.0 to R1.15 .....**Input**

This is for monitoring signals from each function, such as comparison output.

CMP0 to CMP7 .....**Comparison Output Function**

The comparison result of comparison output set value in shared memory and counter current value can be monitored by R1.0 to R1.7.

(Counter current value) < (Comparison output set value) → Comparison output: OFF

(Counter current value) ≥ (Comparison output set value) → Comparison output: ON

Comparison output ON/OFF can also be set as reverse operation.

Output Allocation, NX70 High-Speed Counter Unit (NX70-HSC4)

	External Terminal	Functions				
		Output	Counter	Comparison	Pulse	PWM
External Terminal [II]	A1	R2.0	-	[Comparison CMP0]	-	-
	A2	R2.1	-	[Comparison CMP1]	-	-
	A3	R2.2	-	[Comparison CMP2]	-	-
	A4	R2.3	-	[Comparison CMP3]	-	-
	A5	R2.4	-	[Comparison CMP4]	-	-
	A6	R2.5	-	[Comparison CMP5]	-	-
	A7	R2.6	-	[Comparison CMP6]	-	-
	A8	R2.7	-	[Comparison CMP7]	-	-
	B1	R2.8	-	-	-	-
	B2	R2.9	-	-	-	-
	B3	R2.10	-	-	-	-
	B4	R2.11	-	-	-	-
	B5	R2.12	-	-	-	-
	B6	R2.13	-	-	-	-
	B7	R2.14	-	-	-	-
	B8	R2.15	-	-	-	-
Unit Internal I/O	-	R3.0	CH0 Soft Clear	-	-	-
	-	R3.1	CH0 Soft Mask	-	-	-
	-	R3.2	CH1 Soft Clear	-	-	-
	-	R3.3	CH1 Soft Mask	-	-	-
	-	R3.4	CH2 Soft Clear	-	-	-
	-	R3.5	CH2 Soft Mask	-	-	-
	-	R3.6	CH3 Soft Clear	-	-	-
	-	R3.7	CH3 Soft Mask	-	-	-
	-	R3.8	-	-	-	-
	-	R3.9	-	-	-	-
	-	R3.10	-	-	-	-
	-	R3.11	-	-	-	-
	-	R3.12	-	-	-	-
	-	R3.13	-	-	-	-
	-	R3.14	-	-	-	-
	-	R3.15	-	-	-	-

- : No output allocation

[ ] : Indicate the connector pins on which the comparison results are directly output in order to send to an external device. But the signal states are saved in the input contacts, R1.0 to R1.7, so that you can monitor them with the programming software.

ATTENTION

The I/O number allocations above are applied when NX70 PLC High-speed counter unit(4CH) is installed in slot 0. I/O number can differ depending on the installation slot.

Detailed Descriptions on Occupied I/O Points

External Output

R2.0 to R2.15 .....**Output**

Operated as output.

But, if there is high-performance output allocation, high-performance output is sent to I/O connector.

It can be used as internal relay when not being used for external output.

CMP0 to CMP7 .....**Comparison Output Function**

Comparison result output that has been calculated by comparison output functions.

This output is directly allocated to external output terminal (**[** II **]** A1 to A8), and its output (R) (R2.0 to R2.7) can be used for PLS direction or internal relay. Comparison output can be monitored by internal input (R) with same name.

Internal Output

R3.0 to R3.15 .....**Output**

This output is a controlling signal for each functions such as counter function.

It can be used as internal relay when not allocated to any function.

CHx Soft Clear .....**Counter Function**

Output when counter current value is to be cleared.

Counter current value is cleared to zero (0) by this output (R3.0, R3.2, R3.4, R3.6).

CHx Soft Mask .....**Counter Function**

Output for counter pause.

When this output (R3.1, R3.3, R3.5, R3.7) turns on, counter is paused.

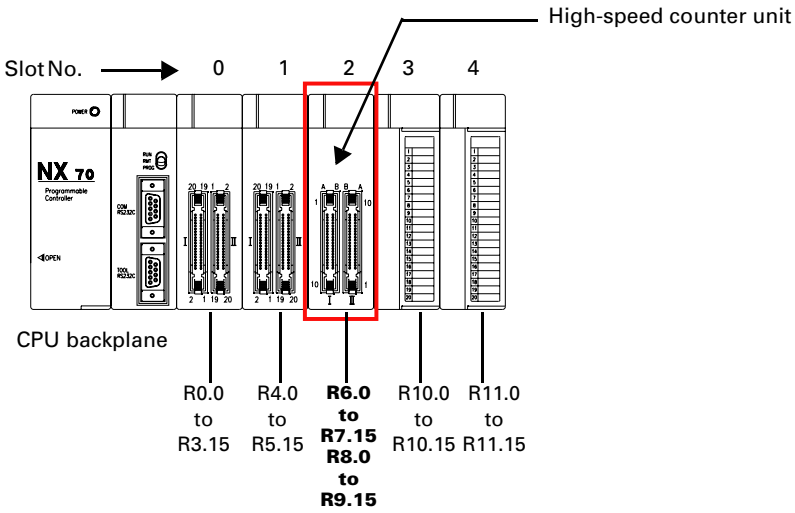
Verification of Allocated I/O Number and Slot No.

- I/O number and slot number is necessary for programming.
- I/O number changes with backplane installation location. Make sure it is same with design.
- For I/O allocation, See *"I/O Number Allocation" in Chapter 3* of each PLC system manual.

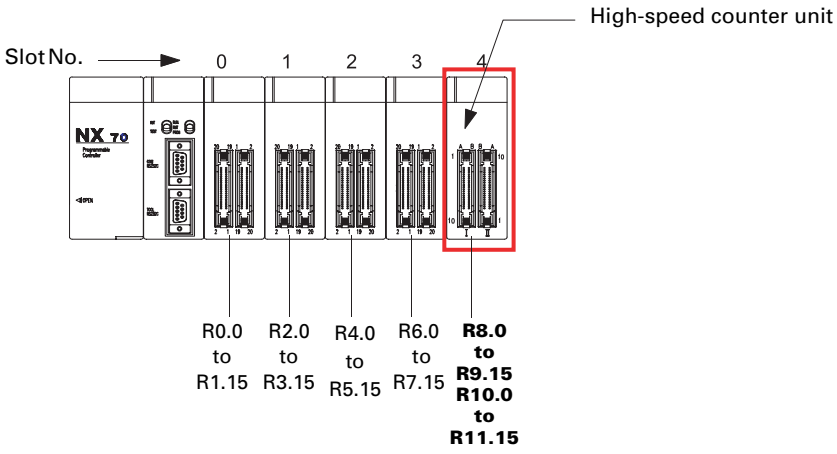
I/O Number Allocation Verification

Check the occupied I/O area of the entire unit with HSC unit.

(Ex.) When a HSC unit is installed next to two I/O units on a CPU backplane



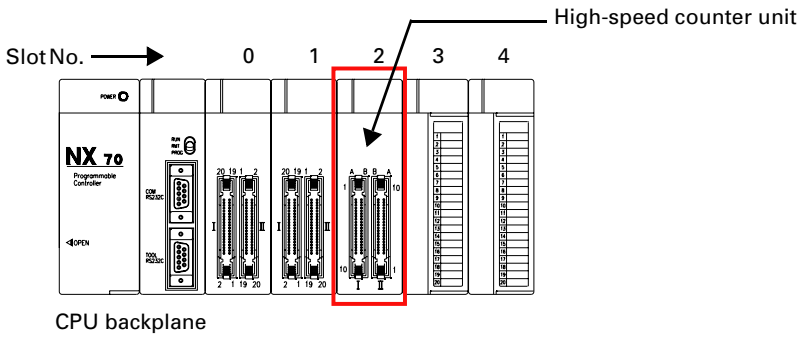
(Ex.) When a HSC unit is installed next to four I/O units on a CPU backplane



Verification of Slot No.

When mounted on CPU backplane

The first slot on the right of CPU is 0, and the others are numbered as their location order.



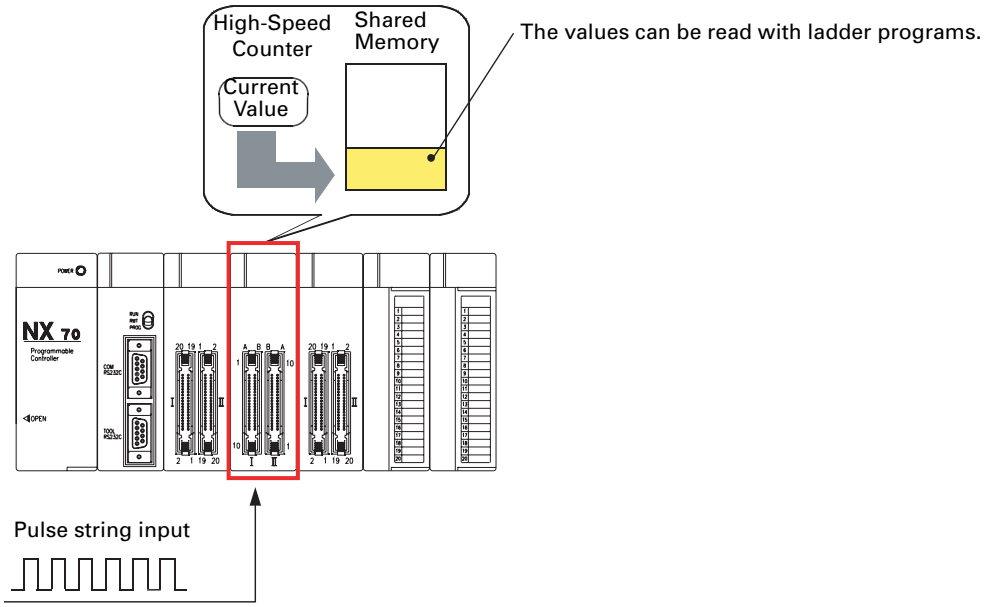
CPU backplane

Embedded Counter

Embedded Counter Functions

Embedded Counter Functions

- Input pulse counting functions is embedded in the HSC unit.
- Counted values are stored in the shared memory areas of each channel.
- Stored values can be read by a program, so current value can be checked.
- With comparison functions, external output can be set according to count value.



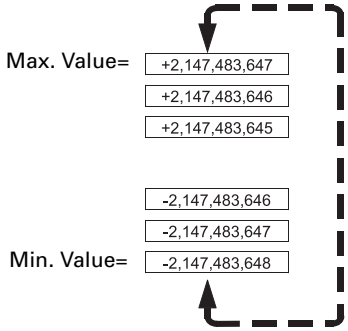
Embedded Counter Operation

- Count value is set to zero (0) on power off.
- Count value (current value) stored in shared memory can be read with the READ instruction.
- Count value (current value) can be modified with the WRITE instruction.

Count Range of the Counter

-2,147,483,648 to +2,147,483,647 (signed 32bit)

When current value exceeds max. (min.), it returns to min. (max.) without error. In this case no error occurs.



Shared Memory Address for Storing Counter Value

Share Memory Address (heximal)		Event	
CH0	108h, 109h	Current value count	Signed 32bit -2,147,483,648 to +2,147,483,647
CH1	10Ah, 10Bh		
CH2	10Ch, 10Dh		
CH3	10Eh, 10Fh		

Read Current Value

Use the READ instruction to read the count value (current value) from the shared memory of HSC unit.

Description

Read 2 words of counter current value data of CH0, stored in shared memory of HSC unit mounted in slot 0, and store the data in W100 to W101 of CPU unit.

About Assigned Address

Data (current value) is stored as 32bit data.

Share Memory Address (heximal)		Event	
CH0	108h, 109h	Current value count	Signed 32bit -2,147,483,648 to +2,147,483,647
CH1	10Ah, 10Bh		
CH2	10Ch, 10Dh		
CH3	10Eh, 10Fh		

Current Value Input

Use the WRITE instruction to enter the count value (current value) into the shared memory of HSC unit.

Description

Store 2 words of data from CPU unit W100 to W101 into counter current value data stored in HSC unit shared memory.

About Assigned Address

Data (current value) is stored as 32bit data.

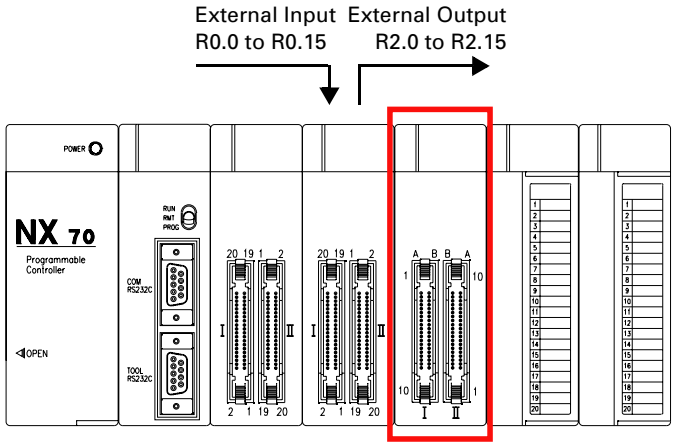
Share Memory Address (heximal)			Event
CH0	108h, 109h	Current value count	Signed 32bit -2,147,483,648 to +2,147,483,647
CH1	10Ah, 10Bh		
CH2	10Ch, 10Dh		
CH3	10Eh, 10Fh		

General I/O Function

General I/O Function

What is General I/O Function?

- General I/O function means the general I/O, represented by input and output units.
  HSC has high-performance functions like counter function, but I/O without allocations for high-performance functions is used for general I/O functions.
- When used along with input time constant functions, it can be used as I/O with input time constant functions, which provides high-performance I/O with stronger noise immunity.



- The I/O number allocations above are applied when HSC unit is installed in slot 0.

How to use General I/O Function?

All I/O of HSC unit can be used for general I/O function. But when high-performance functions are allocated, high-performance functions allocated, such as high-speed counter function, the allocated functions have higher priority.

Using Method

- Special settings such as mode setting switch or shared memory settings are not needed for general I/O unit usage.
  Use with initial setting.
- When HSC unit is installed in slot 0, input R0.0 to R0.15 and output R2.0 to R2.15 can be used for external I/O contacts.

IMPORTANT Terminals not allocated for functions can be used for general I/O, which provides system configuration without losses, including counter functions and sensor input only with a single HSC unit.

Input Time Constant Function

Input Time Constant Function

What is Input Time Constant Function?

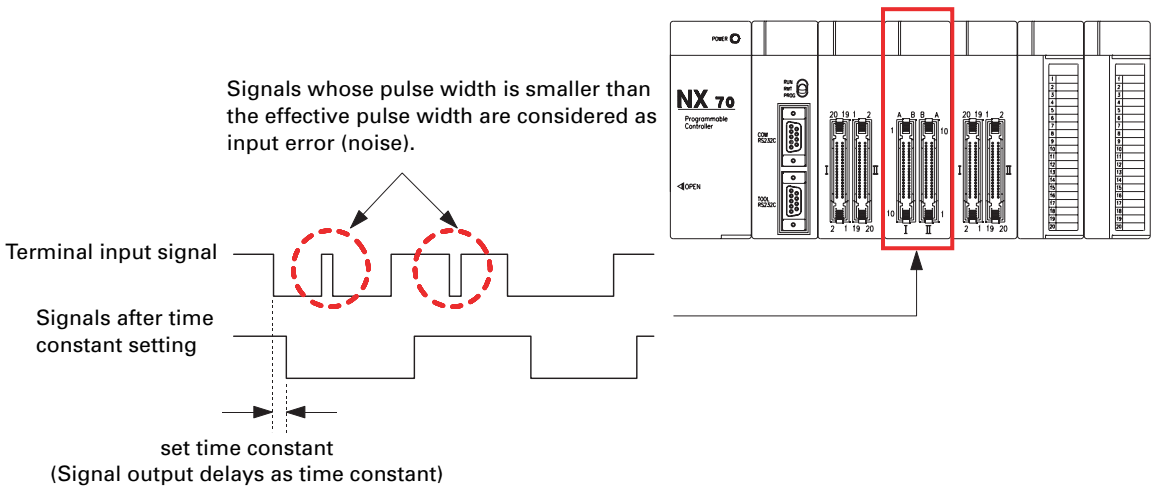
- Setting the effective pulse width for the input signals from external input terminal. Input signal whose pulse width is smaller than the effective pulse width are considered as noise.
- Time constant can be selected from the following, and width signals over the set value are recognized as signals.

  1) 4 μs
  2) 8 μs
  3) 16 μs
  4) 32 μs

- Time constant can be set individually for each of 8 external input terminal groups.

	External input terminal [I]	Input allocation
1)	A1, A2	R0.0, R0.1
2)	A3, A4	R0.2, R0.3
3)	A5, A6	R0.4, R0.5
4)	A7, A8	R0.6, R0.7
5)	B1, B2	R0.8, R0.9
6)	B3, B4	R0.10, R0.11
7)	B5, B6	R0.12, R0.13
8)	B7, B8	R0.14, R0.15

(NX70 High-Speed Counter Unit NX70-HSC4)



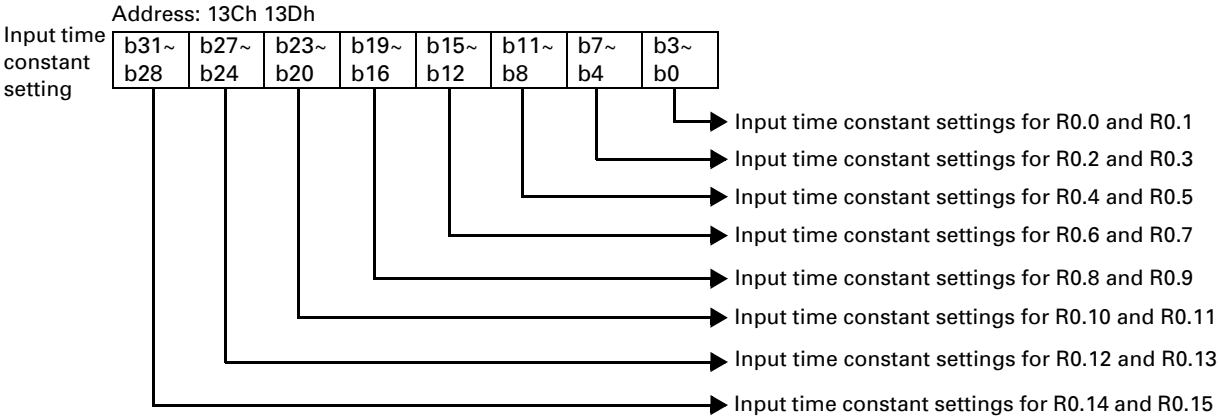
IMPORTANT Input constant functions can be used along with counter function.

Input Time Constant Functions

- To use input time constant functions, shared memory setting is needed.

Using Method

- Set input constant for 8 external input terminal groups by setting shared memory.
- Input time constant is set for external output terminal, so function allocation for each of input R0.0 to R0.15 settings are also valid. (Counter input)



Input Time Constant Setting

Set value (HEX)	Functions	
	Input time constant	Effective pulse width
0	Used	4 μs
1		8 μs
2		16 μs
3		32 μs
4	Invalid(1)	Invalid(1)
5		
6		
7		
8		
9		
A		
B		
C		
D		
E		
F	Unused(2)	-

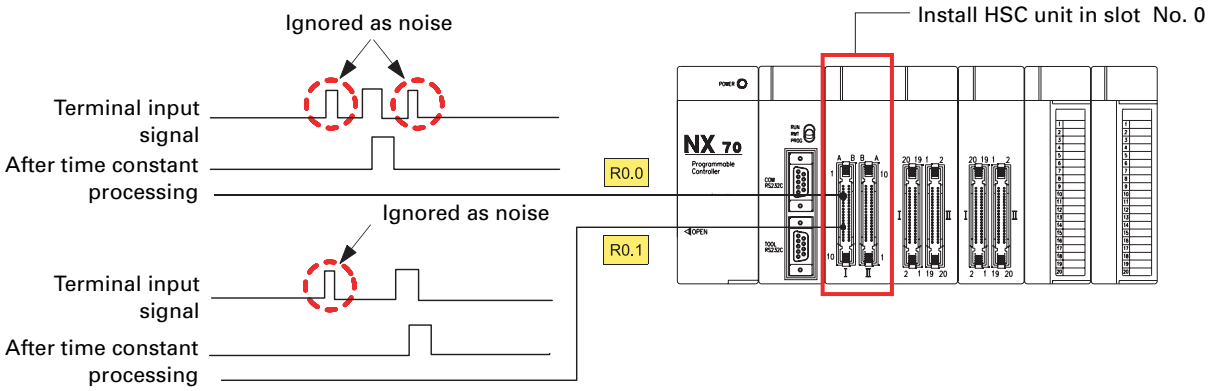
(1) Do not use this setting.

(2) Initial value on power input is set to unused.

ATTENTION Make sure to access shared memory by 2 word unit.

Use Input Time Constant Function

Overview



Set time constant for R0.0, R0.1 input, and ignore signals whose pulse width is smaller than the effective pulse width as noise.

Shared Memory Setting

Time constant setting

Set input time constant.
In the example, R0.0, R0.1 time constant of 16 μs is set for R0.0 and R0.1 input. Therefore, enter 「FFFFFFF2」 into shared memory address 13Ch and 13Dh.

Shared memory 13Ch, 13Dh settings

(bit) 32				16 15				0
External input	R0.15, R0.14	R0.13, R0.12	R0.11, R0.10	R0.9, R0.8	R0.7, R0.6	R0.5, R0.4	R0.3, R0.2	R0.1, R0.0
Set value	F	F	F	F	F	F	F	2
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Unused	16 μs

NOTE See *"Shared Memory Areas" in Chapter 1* for shared memory addresses.

High-Speed Counter Function

High-Speed Counter Function

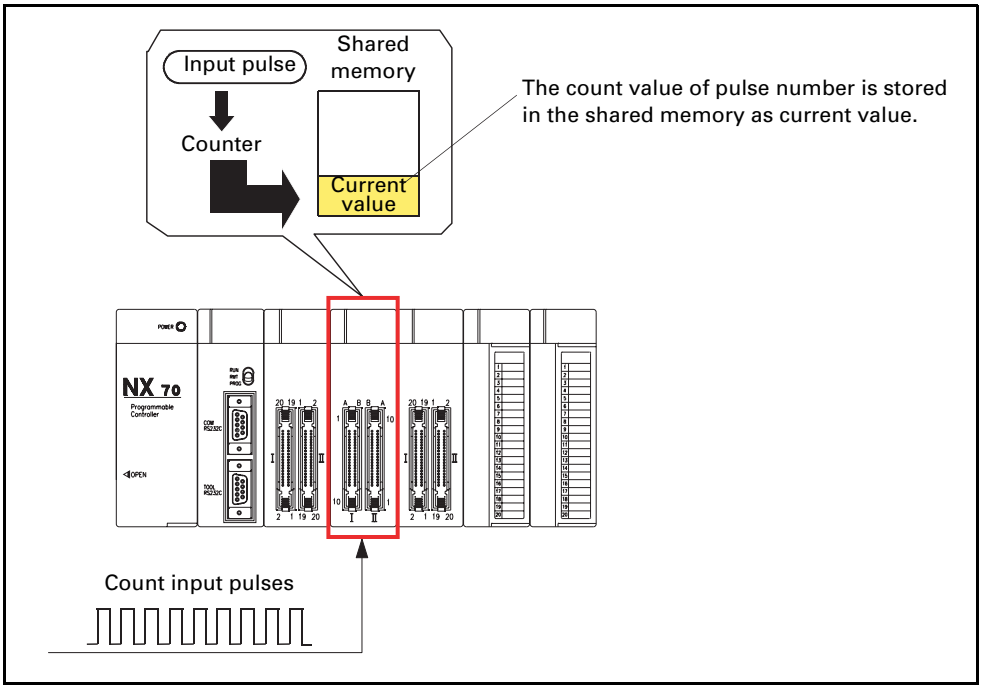
What is Counter Function?

- Counter function counts the input pulse number and reflect it into the current value. Also, it set the offset value by recording data into the current value.
- HSC unit has 4 channels of 2 phase input counter. There are three types of 2 phase input mode as follows.

  1) Direction Control Mode

  2) Individual Input Mode

  3) Phase Input Mode

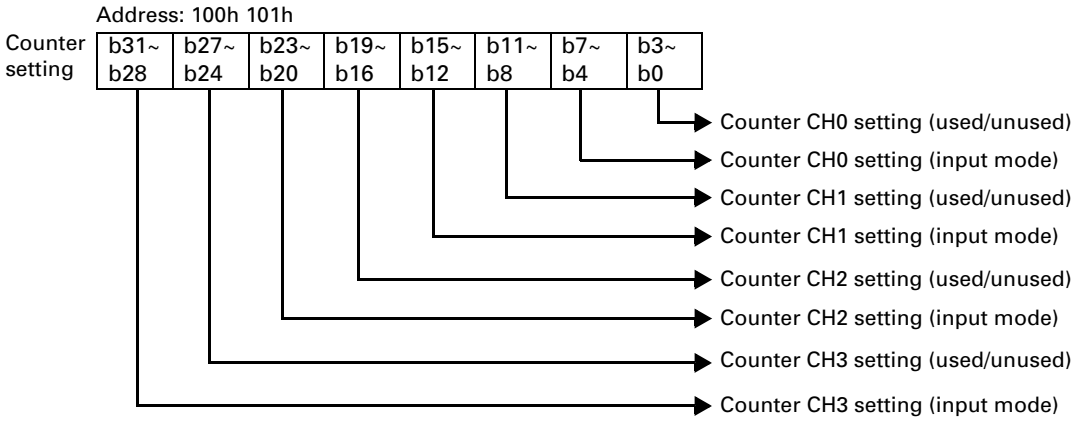


Setting Counter Function

- To use counter function, shared memory setting is needed.
- Besides shared memory setting, counter can be masked or cleared with counter control signal.

Step 1. Shared Memory Setting

Set the operation mode for each counter CH in the shared memory settings. Set the counter functions mode as shown in the table below.



Setting (Input Mode): Effective only for terminal input

Set value (HEX)	Functions	
	Terminal input mode	Multiplication
0	Direction control[2]	N/A
1	Individual input	
2	Phase input	1 multiplication
3		2 multiplications
4		4 multiplications
5	Invalid[1]	
6		
7		
8		
9		
A		
B		
C		
D		
E		
F		

Setting (Function)

Set value (HEX)	Functions
	Counter
0	Used (Terminal input)
1	
2	Invalid[1]
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	Unused[2]

[1] Do not use this setting.

[2] Initial values on power input are set as direction control for input mode and unused for function setting.

ATTENTION Make sure to access shared memory by 2 word unit.

Step 2. Counter Control Signal

- Counter functions can set mask or clear with counter control signal.
- There are two types of counter control signals as follows: **Control by external input terminal** and **Control by programming**. Both allow counter control.

Control by external input terminal

Control Signals (External input terminal)

External terminal		Input allocation	Function		
NX70			Subject counter	Control events	Remarks
[I]	A3	R0.2	CH0	Clear	Count current value is cleared to 0 with input ON.
	A4	R0.3		Mask	Count is paused with input ON.
	A7	R0.6	CH1	Clear	Count current value is cleared to 0 with input ON.
	A8	R0.7		Mask	Count is paused with input ON.
	B3	R0.10	CH2	Clear	Count current value is cleared to 0 with input ON.
	B4	R0.11		Mask	Count is paused with input ON.
	B7	R0.14	CH3	Clear	Count current value is cleared to 0 with input ON.
	B8	R0.15		Mask	Count is paused with input ON.

Control by programming

Control Signals (Internal output terminal)

Output allocation	Function		
	Subject counter	Control events	Remarks
R3.0	CH0	Clear	Count current value is cleared to 0 with output ON.
R3.1		Mask	Count is paused with output ON.
R3.2	CH1	Clear	Count current value is cleared to 0 with output ON.
R3.3		Mask	Count is paused with output ON.
R3.4	CH2	Clear	Count current value is cleared to 0 with output ON.
R3.5		Mask	Count is paused with output ON.
R3.6	CH3	Clear	Count current value is cleared to 0 with output ON.
R3.7		Mask	Count is paused with output ON.

ATTENTION

Be careful that when counter output is internally connected, the control input (by external terminal) from I/O connector is ignored.

Read Counter Current Value

- Current value of each counter is stored in shared memory as described below.
- Use the READ instruction (reading data from high-performance units) to read the current value by 2 word unit.

	Address: 108h 109h
Counter CH0 Current value	K-2,147,483,648 to K+2,147,483,647
	Address: 10Ah 10Bh
Counter CH1 Current value	K-2,147,483,648 to K+2,147,483,647
	Address: 10Ch 10Dh
Counter CH2 Current value	K-2,147,483,648 to K+2,147,483,647
	Address: 10Eh 10Fh
Counter CH3 Current value	K-2,147,483,648 to K+2,147,483,647

Current Value Input

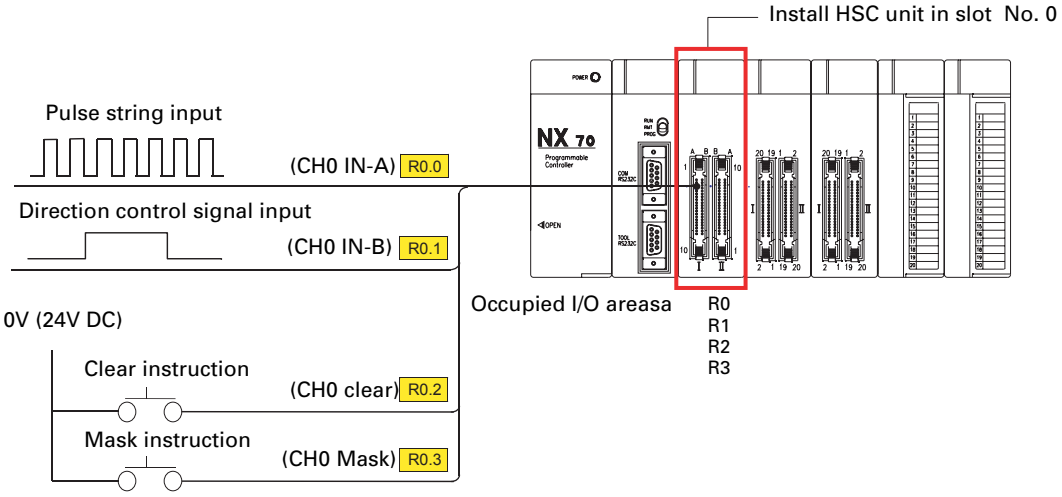
- Current value of each counter is stored in shared memory as described below.
- Enter current value by 2 word unit, using the WRITE instruction (data writing at high-performance unit).

	Address: 108h 109h
Counter CH0 Current value	K-2,147,483,648 to K+2,147,483,647
	Address 10Ah 10Bh
Counter CH1 Current value	K-2,147,483,648 to K+2,147,483,647
	Address : 10Ch 10Dh
Counter CH2 Current value	K-2,147,483,648 to K+2,147,483,647
	Address : 10Eh 10Fh
Counter CH3 Current value	K-2,147,483,648 to K+2,147,483,647

IMPORTANT Counter offset value can be set by counter current value input.

Count Function Available as Direction Control Mode

Overview

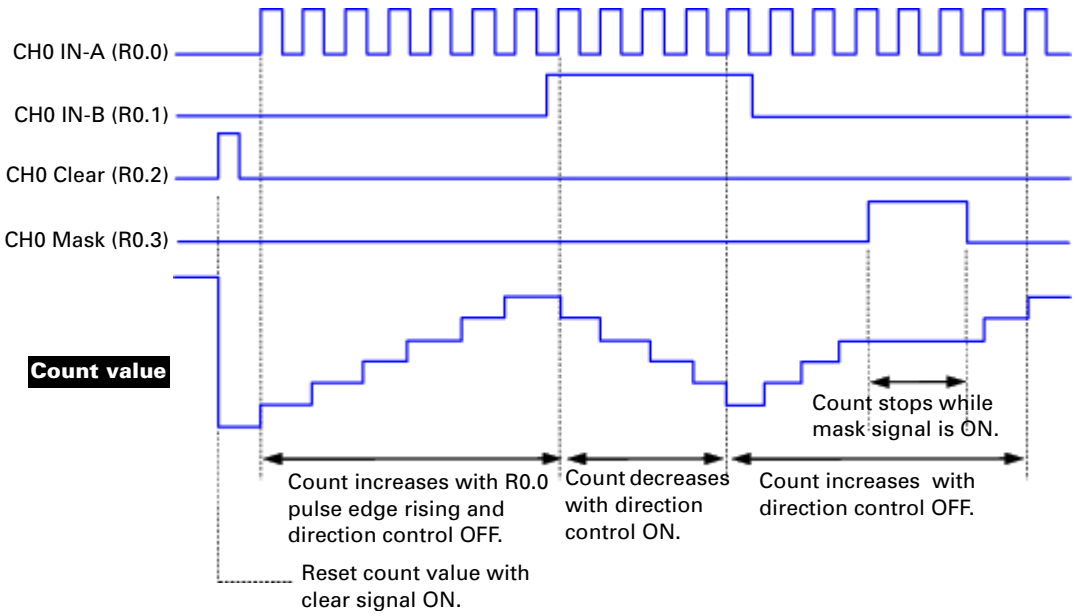


Input pulse string in R0.0 and direction control signal in R0.1 and measure the count number.

Counter current value is cleared with R0.2 clear instruction, and count operation is paused with R0.3 mask instruction.

Timing Diagram

Count value changes according to the input status of each signal is illustrated below. Count value changes at the pulse input edge rise time.



Shared Memory Setting

Counter setting

Setting the operation mode for each counter CH.

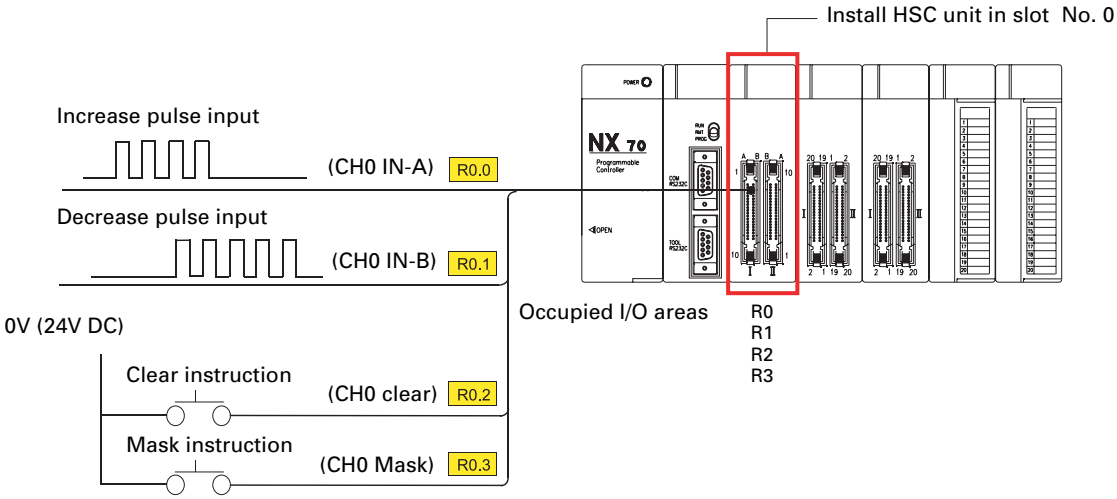
In the example, pulse string is input to R0.0 and direction control signal to R0.1, and counter function is used in direction control mode. Enter 「FFFFFF00」 to shared memory addresses 100h and 101h.

Shared memory 100h, 101h settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	0	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Direction control	Terminal Input

Count Function Available as Individual Input Mode

Overview



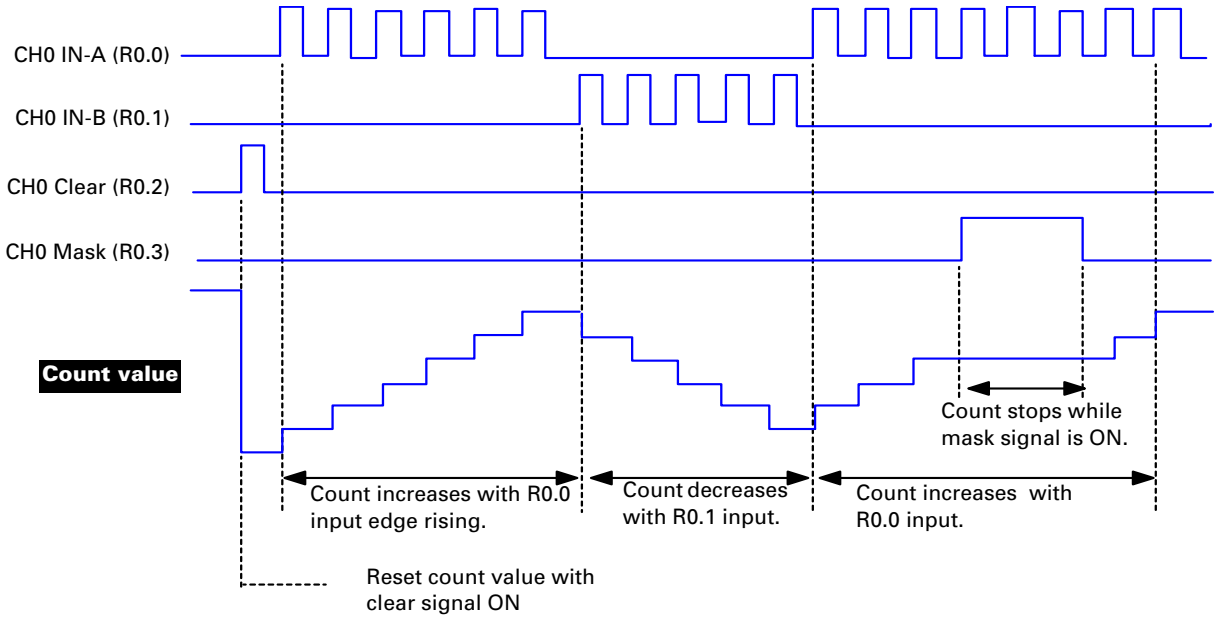
Input increase pulse in R0.0 and decrease pulse in R0.1 and measure the count number.

Counter current value is cleared with R0.2 clear instruction, and count operation is paused with R0.3 mask instruction.

Timing Diagram

Count value changes according to the input status of each signal as illustrated below.

Count value changes at the edge rise time of each signal.



Shared Memory Setting

Counter setting

Setting the operation mode for each counter CH.

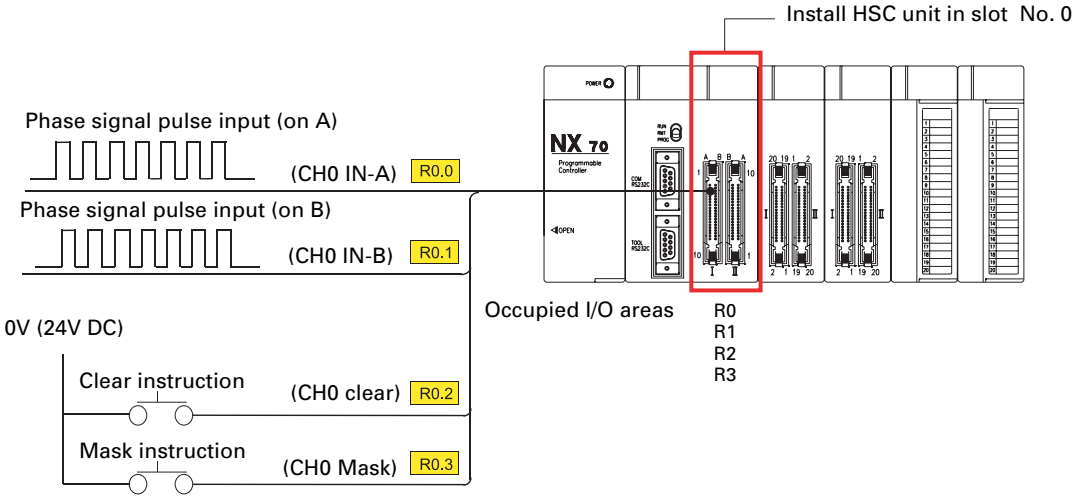
In the example, increase pulse string is input to R0.0 and decrease pulse string to R0.1, and counter function is used in individual input mode. Enter「FFFFFF10」to shared memory addresses 100h and 101h.

Shared memory 100h, 101h settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	1	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Individual Input	Terminal Input

Count Function Available as Phase Input Mode

Overview



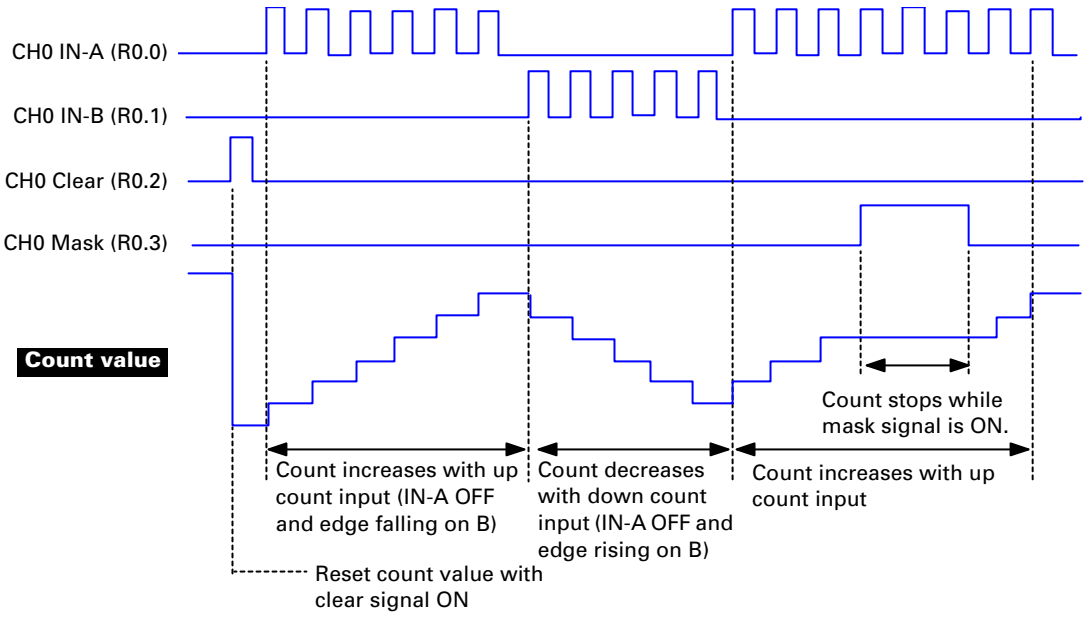
Phase signal from encoder is input to R0.0 and R0.1 and measures the count number.

Counter current value is cleared with R0.2 clear instruction, and count operation is paused with R0.3 mask instruction.

Timing Diagram

Count value changes according to the input status of each signal is illustrated below.

Count value increase with IN-A OFF and IN-B edge falling with 1 multiplication, and decrease with IN-A OFF and IN-B edge rising.



Shared Memory Setting

Counter setting

Setting the operation mode for each counter CH.

In the example, the phase signal from encoder is input to R0.0 and R0.1, and counter function is used in 1 multiplication phase input mode, and therefore enter「FFFFFF20」to shared memory addresses 100h and 101h.

Shared memory 100h, 101h settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	2	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Phase Input	Terminal Input

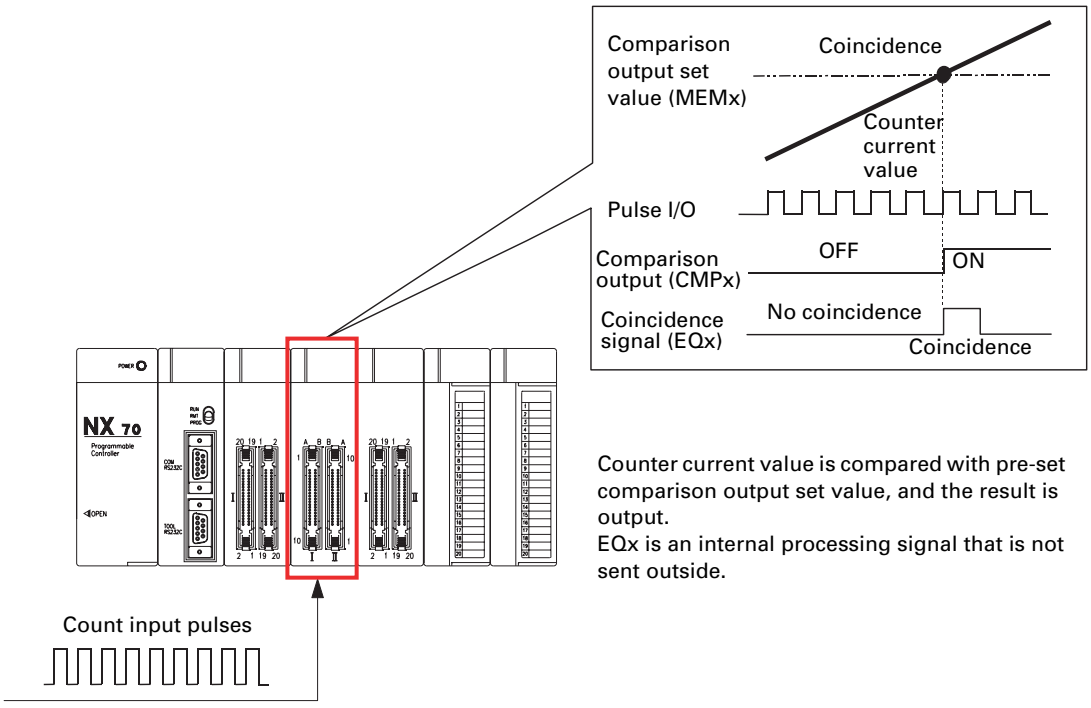
IMPORTANT In phase differential input mode, the input pulse magnification can be changed with multiplication function. See *"Chapter 2"* for details .

Comparison Output Function

Comparison Output Function

What is Comparison Output Function?

- Compare the comparison output set value and counter current value, and the comparison result is output.
  Comparison result output [CMPx]:
  Comparison output set value ≤ Counter current value
- Comparison result output can be selected from either ON when current value < set value or current value ≥ set value.
- For HSC unit, 8 types of comparison output set values can be set, and the comparison counter channels can also be freely selected. Therefore, if all comparison output set values are set to a single counter, a maximum of 8 level comparisons are available.



Counter current value is compared with pre-set comparison output set value, and the result is output.
EQx is an internal processing signal that is not sent outside.

Setting Comparison Output Function

To use comparison output function, **SETP 1. Shared Memory Setting for Comparison Output Set Value** and **STEP 2. Shared Memory Setting for Comparison Output Point** are needed.

Step 1. Shared Memory Setting for Comparison Output Set Value

Set the comparison output set value to be compared with counter current value.

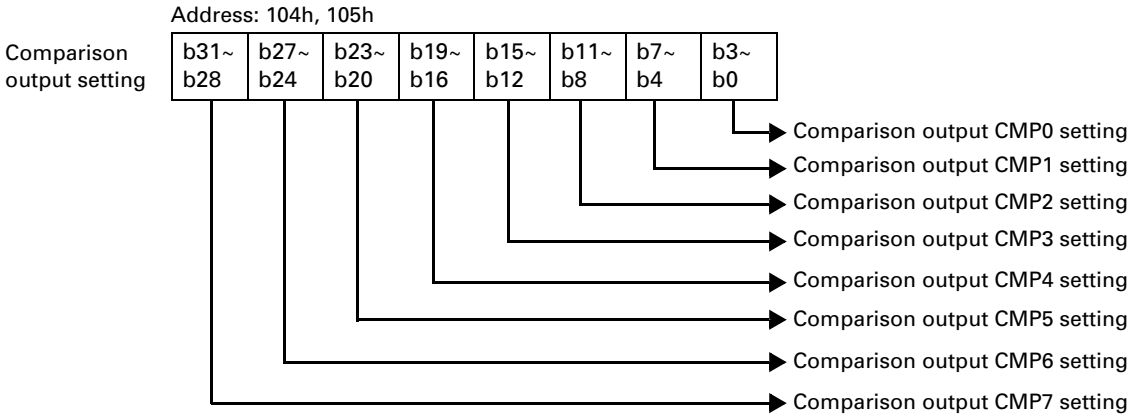
Comparison output set value (for CMP0)	MEM0	Address: 120h 121h K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP1)	MEM1	Address: 122h 123h K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP2)	MEM2	Address: 124h 125h K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP3)	MEM3	Address: 126h 127h K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP4)	MEM4	Address: 128h 129h K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP5)	MEM5	Address: 12Ah 12Bh K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP6)	MEM6	Address: 12Ch 12Dh K-2,147,483,648 to K+2,147,483,647
Comparison output set value (for CMP7)	MEM7	Address: 12Eh 12Fh K-2,147,483,648 to K+2,147,483,647

ATTENTION Make sure to access shared memory by 2 word unit.

NOTE See *"Shared Memory Areas" in Chapter 1* for shared memory addresses.

Step 2. Shared Memory Setting for Comparison Output Point

Select the counter CH to be compared with comparison output set value, and output logic.



Comparison Output Setting

Set value (HEX)	Functions		
	Comparison output function	Output logic	Counter CH to be compared
0	Used	ON when current value < set value	CH0
1			CH1
2			CH2
3			CH3
4		ON when current value ≥ set value	CH0
5			CH1
6			CH2
7			CH3
8	Invalid(1)	Invalid(1)	
9			
A			
B			
C			
D			
E			
F	Unused(2)	-	

(1) Do not use this setting.

(2) Initial values on power input are set as unused.

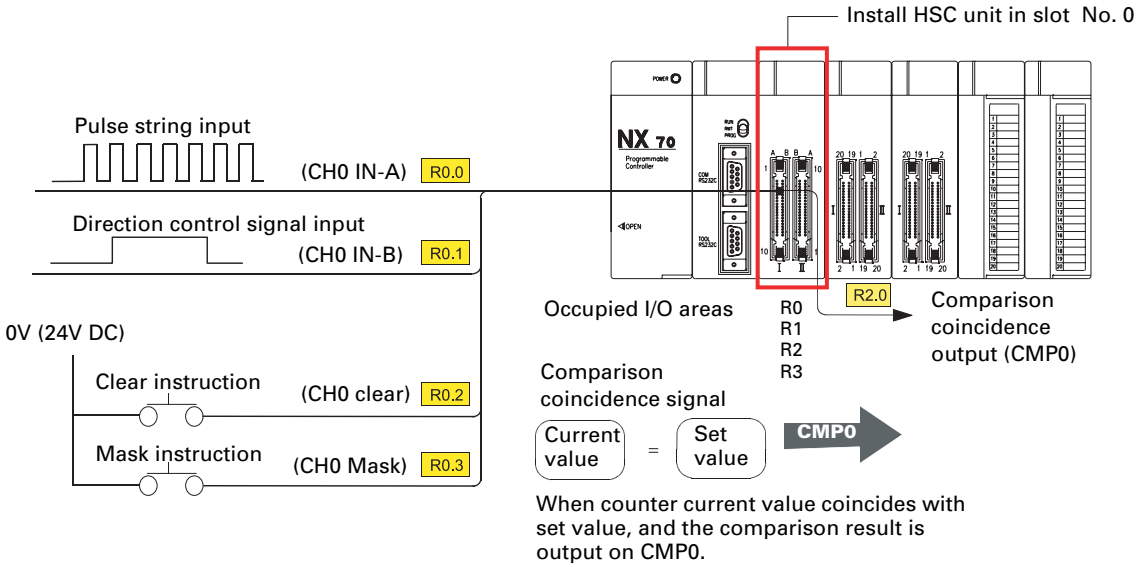
ATTENTION

- Make sure to access shared memory by 2 word unit.
- When using this setting regardless of counter function use setting (ON/OFF), be careful that comparison output set value and counter current value are compared.
- When setting the comparison output function, make sure to first set shared memory for Comparison Output Set Value. Otherwise, coincidence output is generated at the time of data setting if the comparison output condition is met, as in the case that counter initial value and comparison output set value are both 0.

NOTE See *"Shared Memory Areas" in Chapter 1* for shared memory addresses.

Comparison Output Function with Counter

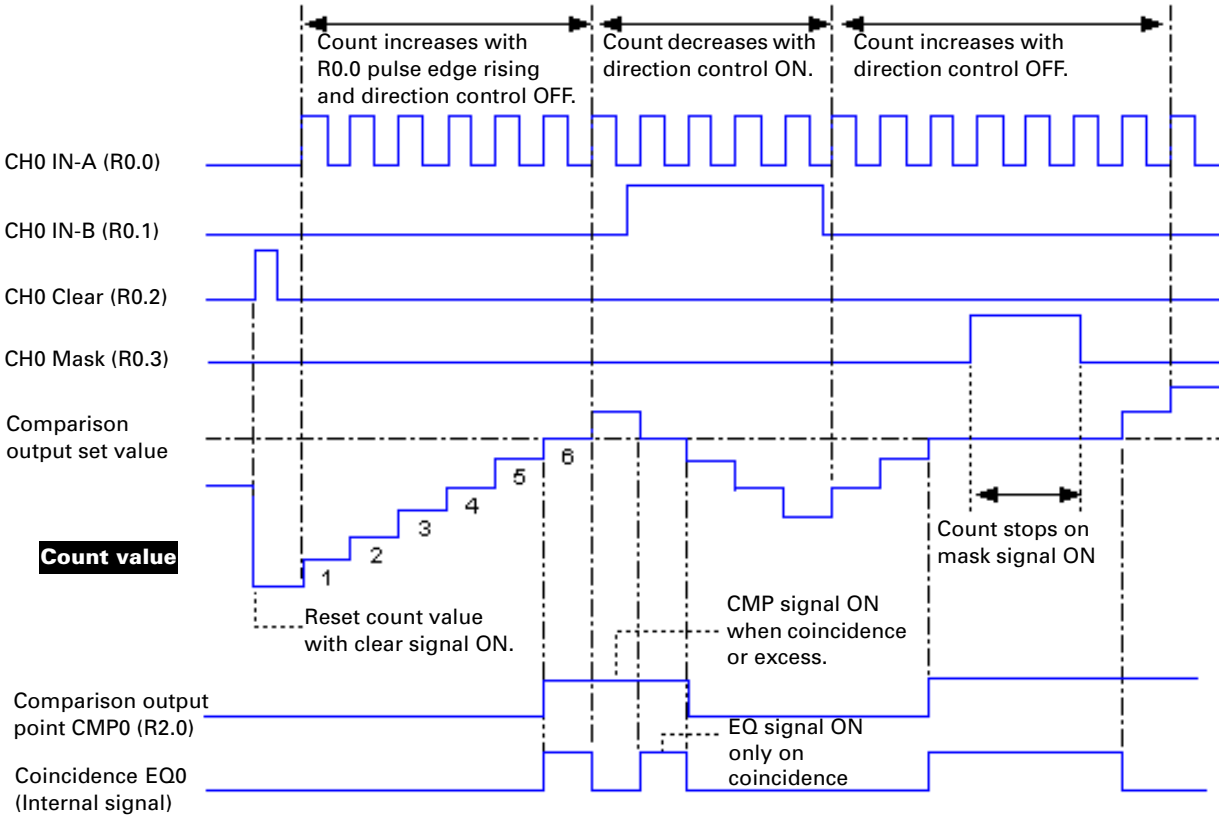
Overview



Counter current value is compared with pre-set comparison output set value, and the comparison result is output. This function is available in all counter operation modes, but in this example the counter is used in direction control mode.

Timing Diagram

Count value changes according to the input status of each signal as illustrated below.



Shared Memory Setting

Counter Setting

Setting the operation mode for each counter CH.

In the example, pulse string is input to R0.0 and direction control signal to R0.1, and counter function is used in direction control mode. Enter 「FFFFFF00」 to shared memory addresses 100h and 101h.

Shared Memory 100h, 101h Settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	0	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Direction Control	Terminal Input

Setting the Comparison Output Set Value

Setting the comparison output set value to be compared with Counter current value.

In the example, the comparison result is output on CMP0 when counter current value is 6. Enter 「K6(H6)」 in shared memory addresses 120h, 121h.

Shared Memory 120h, 121h Settings

(bit) 32					16 15			0
Setting item	Comparison output set value (CMP0)							
Set value	0	0	0	0	0	0	0	6
Settings	K6							

Setting the Comparison Output Point

Select the counter channel number and output logic for each comparison output point.

In the example, counter current value at CH0 is compared with comparison output set value and the comparison result is output on CMP0. Therefore, enter 「FFFFFFF4」 in shared memory addresses 104h and 105h.

Shared Memory 104h, 105h Settings

(bit) 32					16 15			0
Comparison input	CMP7	CMP6	CMP5	CMP4	CMP3	CMP2	CMP1	CMP0
Set value	F	F	F	F	F	F	F	4
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Unused	CH0 Comparison(1)

(1) CMP0 is ON when current value ≥ set value

ATTENTION

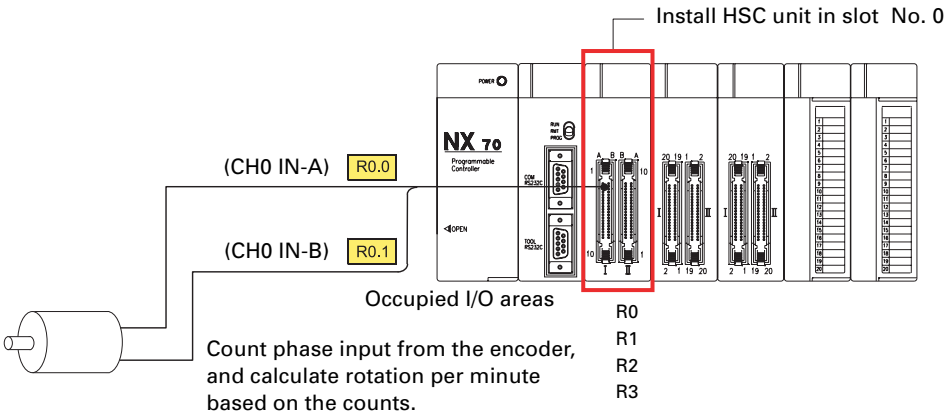
When setting the comparison output function, make sure to first set shared memory for Comparison Output Set Value. Otherwise, coincidence output is generated at the time of data setting if the comparison output condition is met, as in the case that counter initial value and comparison output set value are both 0.

8

Application Examples

Speed Measuring

Overview



Formula for calculation of rotation per minute

$$\text{Rotation per minute} = \frac{\text{Pulse per second}}{\text{Pulse per rotation}} \times 60 = \frac{\text{Pulse per second} \times 60}{1000} = \text{Pulse per second} \times \frac{3}{50}$$

Enter phase signal from encoder in R0.0 and R0.1, and measure count numbers per second. Calculate rotation per minute.
In this example, the resolution of encoder is 1000 pulses/rotation.
Rotation per minute is stored in W6 and W7 for later checking with monitor functions of programming tools such as WinGPC S/W.

Shared Memory Setting

Counter Setting

Setting the operation mode for each counter CH.

In the example, the phase signal from encoder is input to R0.0 and R0.1, and counter function is used in 1 multiplication phase input mode, and therefore enter「FFFFFF20」to shared memory addresses 100h and 101h.

Shared Memory 100h, 101h Settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	2	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Phase input	Terminal input

Counter Current Value Setting

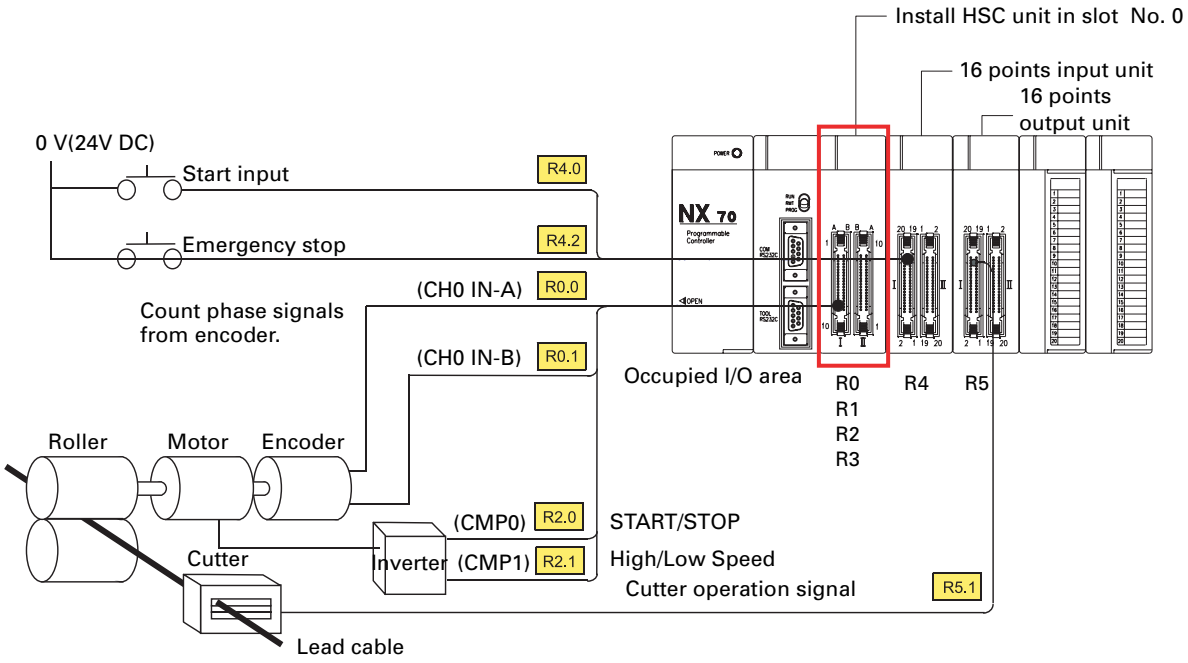
Enter a value that does not coincide with counter current value at CH0. In this example, enter「K-16777216(H FF000000)」in shared memory addresses 108h and 109h where the current value has been stored.

Shared Memory 108h, 109h Settings

(bit) 32					16 15			0
Setting item	Comparison output set value (CMP0)							
Set value	0	0	0	0	0	0	0	0
Settings	K-16777216							

Fixed Length Processing

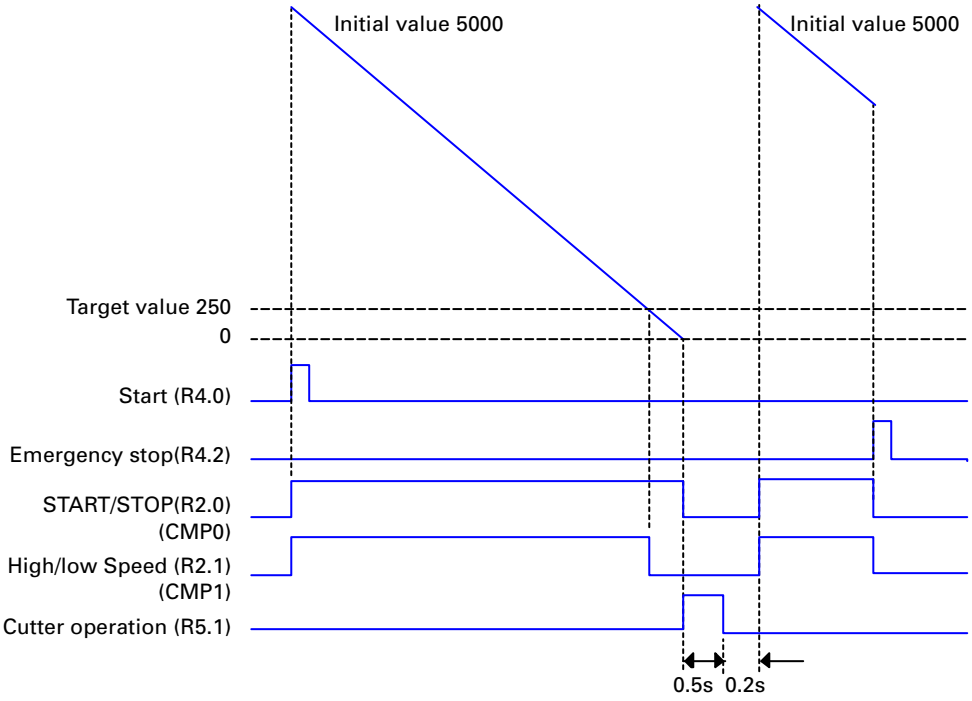
Overview



In the example, a transfer roller with diameter of 10cm and 10cm movement of lead cable by one rotation is used.
With this roller, slow the rotation when lead cable moves 95cm, and stop rotation at 100cm(10 rotations).
In this example, the resolution of encoder is 500 pulses/rotation. Also, pulse output is not used, and inverter start/stop is controlled by CMP0 signal, and high/low speed is controlled by CMP1 signal.

Timing Diagram

Count value and output change according to the input status of each signal as illustrated below.



Shared Memory Setting

Counter setting

Setting the operation mode for each counter CH.
In the example, the phase signal from encoder is input to R0.0 and R0.1, and counter function is used in 1 multiplication phase input mode, and therefore enter「FFFFFF20」to shared memory addresses 100h and 101h.

Shared Memory 100h, 101h Settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	2	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Phase input	Terminal input

Counter Current Value Setting

Enter「K5000 (H1388)」 as count initial value in the shared memory addresses 108h and 109h where the counter current value of CH0 is stored.

Shared Memory 108h, 109h Settings

(bit) 32				16 15			0
Setting item	Comparison output set value (for CMP0)						
Set value	F	F	0	0	1	3	8	8
Settings	K 5000						

Setting the Comparison Output Set Value

Setting the Comparison output set value to be compared with Counter current value.
In the example, enter「K0 (H0)」 in shared memory addresses 120h, 121h and「K250 (H FA)」 in 122h, 123h, to output CMP0 when counter current value is 0 and CMP1 when 250.

Shared memory 120h, 121h settings

(bit) 32				16 15			0
Setting item	Comparison output set value (for CMP0)						
Set value	0	0	0	0	0	0	0	0
Settings	K0						

Shared Memory 122h, 123h Settings

(bit) 32				16 15			0
Setting item	Comparison output set value (for CMP2)						
Set value	0	0	0	0	0	0	F	A
Settings	K250						

Setting the Comparison Output Set Value

Select the counter CH number to be used for comparison output function, and output logic.
In the example, counter current value at CH0 is compared with comparison output set value and the result is output as CMP0 and CMP1. Therefore, enter「FFFFFF44」or「FFFFFF00」in shared memory addresses 104h and 105h.

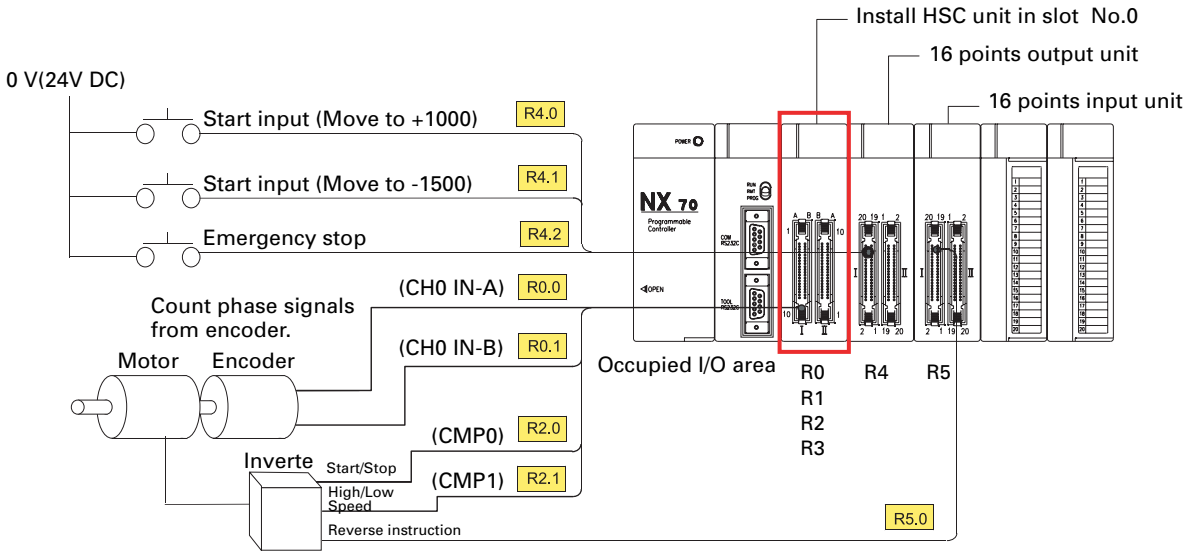
Shared memory 104h, 105h settings

(bit) 32				16 15				0
Comparison Input	CMP7	CMP6	CMP5	CMP4	CMP3	CMP2	CMP1	CMP0
Set value	F	F	F	F	F	F	4	4
Settings	Unused	Unused	Unused	Unused	Unused	Unused	CH0[1] Comparison	CH0[1] Comparison

[1] CMP0 is ON when current value ≥ set value

Location Control by Absolute Value

Overview

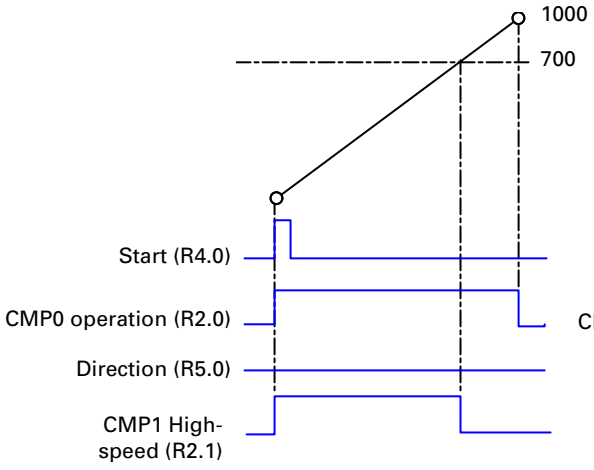


Location is controlled by absolute value. In this example, location changes to +1000 at R4.0 input and -1500 at R4.1 input, and then speed decreases before 300 pulses at the stop point, and finally everything stops. Also, pulse output is not used, and inverter start/stop is controlled by CMP0 signal, and high/low speed is controlled by CMP1 signal.

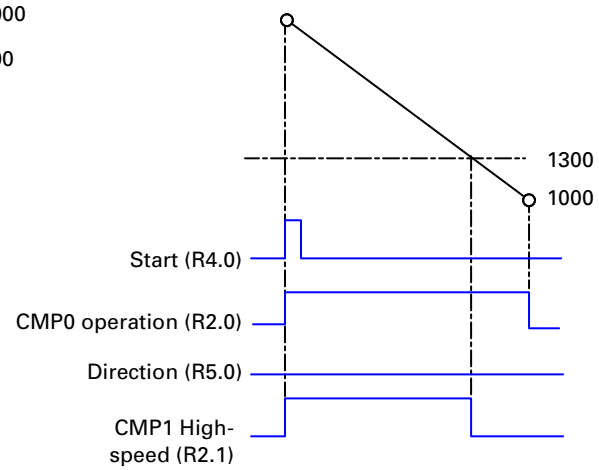
Timing Diagram

Count value and output change according to the input status of each signal as illustrated below.

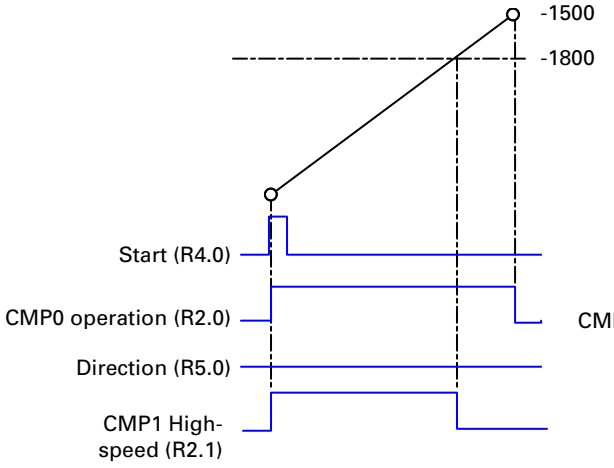
R4.0 ON Target value K1000
(Current value < Target value)



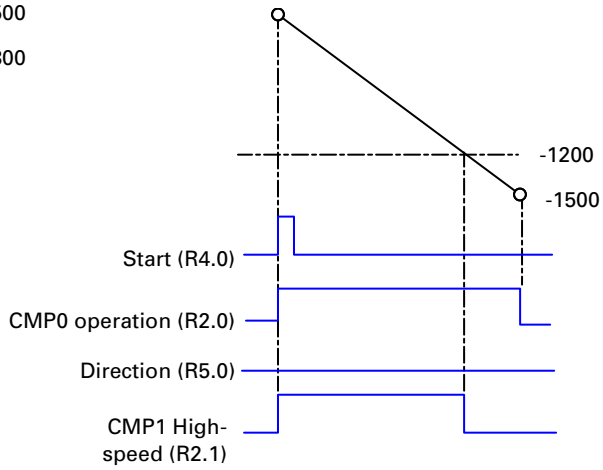
R4.0 ON Target value K1000
(Current value > Target value)



R4.1 ON Target value K-1500
(Current value < Target value)



R4.1 ON Target value K-1500
(Current value > Target value)



Shared Memory Setting

Counter Setting

Setting the operation mode for each counter CH.

In the example, the phase signal from encoder is input to R0.0 and R0.1, and counter function is used in 1 multiplication phase input mode, and therefore enter「FFFFFF20」 to shared memory addresses 100h and 101h.

Shared Memory 100h, 101h Settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	2	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Phase input	Terminal Input

Setting the Comparison Output Set Value

Setting the Comparison output set value to be compared with Counter current value.

In this example, enter「K1000 (H 3E8)」into shared memory addresses 120h and 121h when R4.0 turns ON, and
「K-1500 (H FFFFFA24)」 into 120h and 121h when R4.1 ON.

Shared Memory 120h, 121h Settings (R4.0 ON)

(bit) 32					16 15			0
Setting item	Comparison output set value (for CMP0)							
Set value	0	0	0	0	0	3	E	8
Settings	K 1000							

Shared Memory 120h, 121h Settings (R4.1 ON)

(bit) 32					16 15			0
Setting item	Comparison output set value (for CMP0)							
Set value	F	F	F	F	F	A	2	4
Settings	K-1500							

Setting the Comparison Output Point

Select the counter CH number to be used for comparison output function, and output logic.

In the example, counter current value at CH0 is compared with comparison output set value, and the result is output at CMP0 and CMP1. Therefore, enter 「FFFFFF44」 or「FFFFFF00」 in shared memory addresses 104h and 105h.

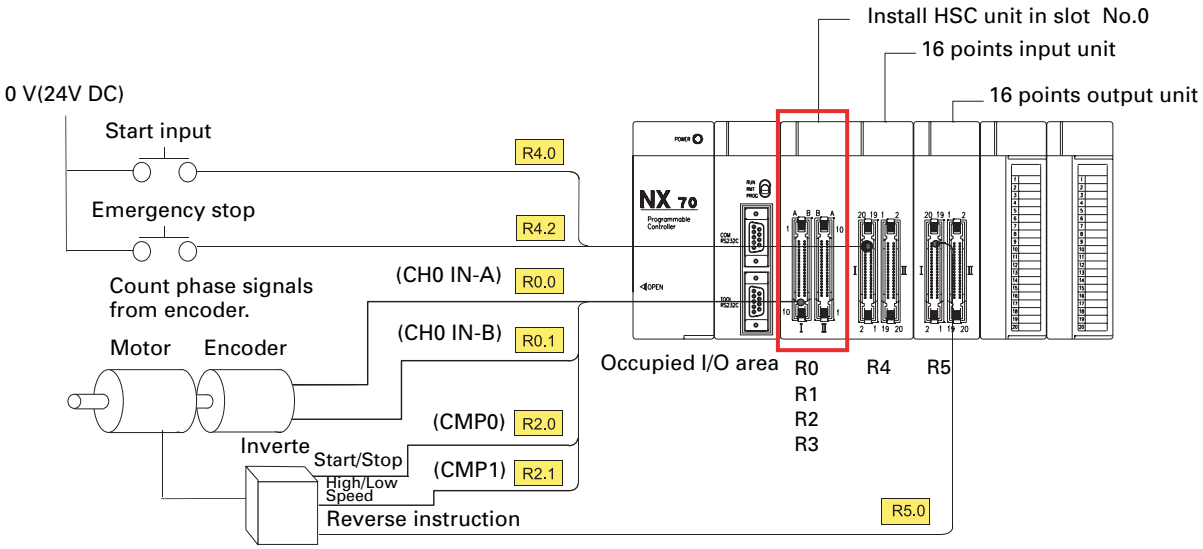
Shared Memory 104h, 105h Settings

(bit) 32					16 15			0
Comparison input	CMP7	CMP6	CMP5	CMP4	CMP3	CMP2	CMP1	CMP0
Set value	F	F	F	F	F	F	4	4
Settings	Unused	Unused	Unused	Unused	Unused	Unused	CH0 (1) Comparison	CH0 (1) Comparison

(1) CMP0 is ON when current value ≥ set value

Location Control by Data Table

Overview



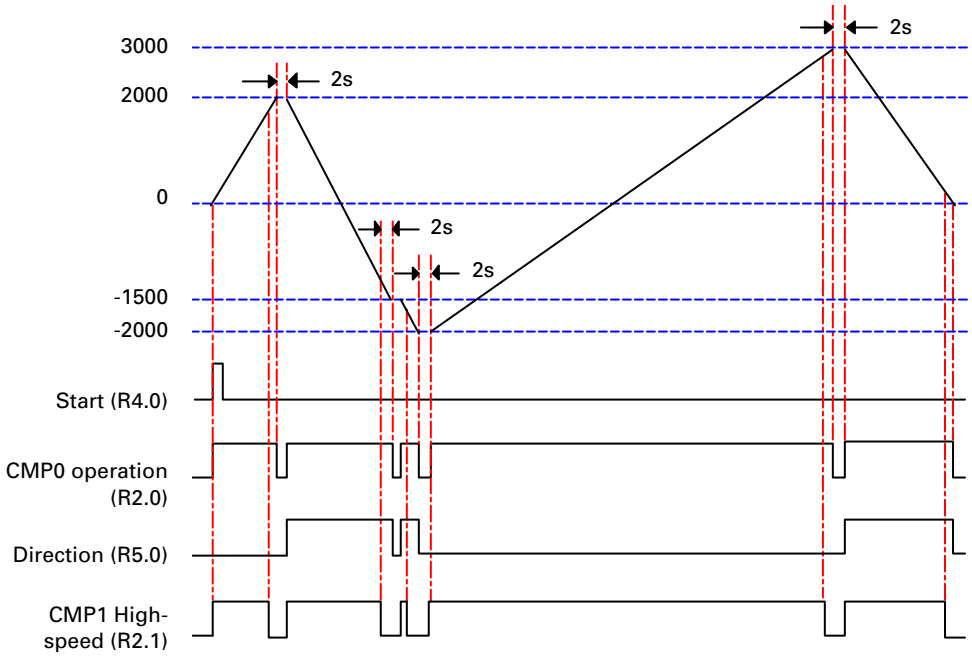
In the example, location is controlled as absolute values according to the set values in data table.
Speed decreases before 300 pulses at the stop point, and finally all stop. Data table is organized as follows, and deceleration point value (relative pulse value) is also registered.

Address	Set value	Event
W10, W11	K 300	Speed turning point
W12, W13	K 2000	Target value 1
W14, W15	K -1500	Target value 2
W16, W17	K -2000	Target value 3
W18, W19	K 3000	Target value 4
W20, W21	K 0	Target value 5

Also, pulse output is not used, and inverter start/stop is controlled by CMP0 signal, and high/low speed is controlled by CMP1 signal.

Timing Diagram

Count value and output change according to the input status of each signal as illustrated below.
Deceleration starts K300 pulses prior to each target value.



Shared Memory Setting

Counter Setting

Setting the operation mode for each counter CH.
In the example, the phase signal from encoder is input to R0.0 and R0.1, and counter function is used in 1 multiplication phase input mode, and therefore enter「FFFFFF20」to shared memory addresses 100h and 101h.

Shared Memory 100h, 101h Settings

(bit) 32					16 15			0
External input	R0.13	R0.12	R0.9	R0.8	R0.5	R0.4	R0.1	R0.0
Counter number	CH3		CH2		CH1		CH0	
Setting item	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting	Input mode	Functions setting
Set value	F	F	F	F	F	F	2	0
Settings	Unused	Unused	Unused	Unused	Unused	Unused	Phase input	Terminal input

Setting the Comparison Output Set Value

Setting the operation mode for each counter CH.
In the example,「K2000(H 7D0)」,「K-1500(H FFFFFA24)」,「K-2000(H FFFFF830)」,「K3000(H BB8)」,「K0(H 0)」is input to shared memory addresses 120h and 121h in sequential order.

Shared Memory 120h, 121h Settings (Target Value 1)

(bit) 32					16 15			0
Setting item	Comparison output set value (for CMP0)							
Set value	0	0	0	0	0	7	D	0
Settings	K 2000							

Shared Memory 120h, 121h Settings (Target Value 2)

(bit) 32					16 15			0
Setting item	Comparison output set value (for CMP1)							
Set value	F	F	F	F	F	A	2	4
Settings	K-1500							

Shared Memory 120h, 121h Settings (Target Value 3)

(bit) 32	16	15	0
Setting item	Comparison output set value (for CMP0)		
Set value	F F F F F 8 3 0		
Settings	K -2000		

Shared Memory 120h, 121h Settings (Target Value 4)

(bit) 32	16	15	0
Setting item	Comparison output set value (for CMP0)		
Set value	0 0 0 0 0 B B 8		
Settings	K 3000		

Shared Memory 120h, 121h Settings (Target Value 5)

(bit) 32	16	15	0
Setting item	Comparison output set value (for CMP0)		
Set value	0 0 0 0 0 0 0 0		
Settings	K 0		

Setting the Comparison Output Point

Select the counter CH number to be used for comparison output function, and output logic.
In the example, counter current value at CH0 is compared with comparison output set value, and the result is output at CMP0 and CMP1. Therefore, enter「FFFFFF44」or「FFFFFF00」in shared memory addresses 104h and 105h.

Shared Memory 104h, 105h Settings

(bit) 32	16	15	0
Comparison input	CMP7 CMP6 CMP5 CMP4 CMP3 CMP2	CMP1	CMP0
Set value	F F F F F F	4	4
Settings	Unused Unused Unused Unused Unused Unused	CH0 (1) Comparison	CH0 (1) Comparison

(1) CMP0 is ON when current value ≥ set value

High-Speed Counter Unit (4CH)

OE MAX CONTROLS

OE MAX Controls

www.oemax.com

Publication NX70-UM004A-EN-P - January 2005